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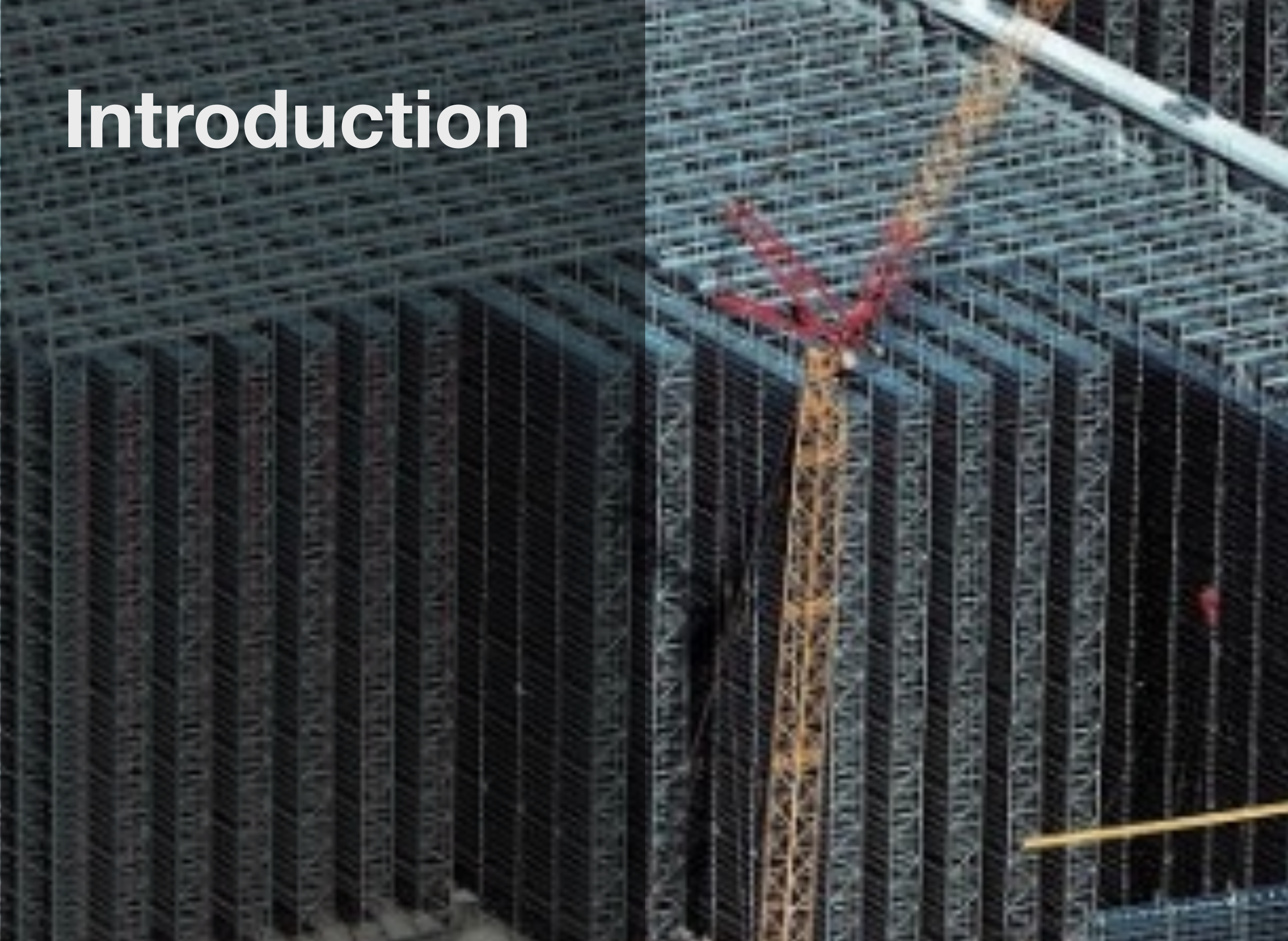
# Introduction to the Automated Warehouse

## Instructor Manual





# Introduction





## Overview

This Instructor's manual accompanies the e-textbook Introduction to the Automated Warehouse. Although it is written with the instructor who is new to the course in mind, it will provide resources useful for instructors of various experience levels.

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*Interactive e-book content provided by the National Center for Supply Chain Technology Education, NSF ATE DUE Award #1104176. Interactive e-book created by E-MATE, E-books and Mobile Apps for Technician Education, NSF ATE DUE# 1205113.*

*This material is based upon work supported by the National Science Foundation under ATE DUE Grant No. 1104176 and ATE DUE Grant No. 1205113.*

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## Acknowledgements

Thank you to the National Science Foundation's Advanced Technological Education Program, the National Center for Supply Chain Technology Education and E-MATE for making the creation of this eTextbook possible. Special thanks to all the Industry experts, Material Handling companies, Supply Chain Technicians (and their supervisors), corporate executives, NSF Principal Investigators, Co-Principal Investigators, senior personnel, contributing faculty, consultants, staff, project leadership team members, the SCTE industry leadership team members, the SCTE national visiting committee, host institutions, and partner organizations. It is because of your leadership, various contributions, collaborations, and passion for technical education that this book exists.

This work is sponsored in part by the National Science Foundation's Advanced Technological Education Program under DUE Award #1104176. Any opinions, findings, conclusions or recommendations presented on our social media platforms are only those of the presenter grantee/researcher, author, or agency employee; and do not necessarily reflect the views of the National Science Foundation. E-MATE, E-books and Mobile Apps for Technician Education is a project sponsored by the National Science Foundation's Advanced Technological Education Program under DUE Award #1205113.

**Editors' Notes:** This manual was prepared under the supervision of Dr. Robert Sompolski, Oakton Community College. Editors and contributors include Dr. John Stovall, Oakton Community College; Ms. Katie Adams; Ms. Olga Cedrina, Oakton Community College; and Mr. Jonathan Shaloum.



## Chapter 1

# Supplemental Resources





## **Case Study 1: What Would You Do?: Worrying About Co-Workers' Non-Compliance with Company Policy**

*Suggested Text Topic: Ch. 4, "Safety"*

Evelyn had only been working for Freedom Logistics and Warehousing for a few months when she noticed that her coworkers were routinely not following company procedures regarding lockout-tagouts (LOTO). Employees had been trained that whenever they "tagged" a piece of machinery with a bright red device in order to repair it or do maintenance work on it, that same employee was the only person who could untag it. On three separate occasions when Evelyn asked who she should contact about untagging a piece of equipment, one of her coworkers would simply untag the piece themselves.

When she asked another coworker, Joshua, about it he pulled her to the side. "Management wants us to follow strict rules about lockout-tagouts but we're

such a small group that we all know who is working on what. If we had to track down the exact person who tagged a device every time we needed to untag it we wouldn't get anything done! We may not be doing it exactly the way management wants but no one is getting hurt, we're just saving time. It's just easier all the way around."

Disturbed by her conversation with Joshua, Evelyn went home that night and reviewed the company's workplace policy manual. She realized that if she went along with the way the crew was working she was violating an Occupational Safety and Health Administration (OSHA) policy and that her own job could be in jeopardy. She could also be held liable if someone did get hurt as a result of not following the policy and she hadn't come forward to let management know the process wasn't being followed.

Evelyn tossed and turned. She wanted to do the right thing and follow company policy but she knew that by going over her supervisor's head and telling



management, she might keep her job but would lose the trust of her coworkers. What do you think Evelyn should do? Why?

**Sources:**

"Lockout/Tagout Fact Sheet." *U.S. Department of Labor Occupational Safety and Health Administration (OSHA)*. 2002. Web. 20 May 2014.



## **Case Study 2: Beyond Borders: Cold Supply Storage and Shipping Saves Lives in Laos**

*Suggested Text Topic:* Ch. 3, “Supply Chain Principles”

According to the World Health Organization (WHO), influenza epidemics bring severe illness to approximately five million people around the world annually. Between 250,000 and 500,000 people die of the viral infection. In the U.S., people are easily able to get flu vaccinations at their doctors’ office or local drug store. However poor countries around the globe lack access to flu vaccines. The U.S. Centers for Disease Control and Prevention (CDC) and the pharmacy chain Walgreens partnered to transfer unused flu vaccine drugs from the U.S. to poor countries in need, instead of destroying the potentially lifesaving drugs as required if not used. Although Walgreens wanted to donate its surplus to the country of Laos, it required specialized supply chain logistics and technological solutions to overcome several challenges including:

**distance** – the medication had to be shipped from Kentucky to the capital of Laos, a distance of more than 8,400 miles

**timing** – the medicine would have to arrive in Laos within the critical window of time immediately before the flu usually strikes

**temperature** – the medicine had to remain at a temperature of between 35.6 degrees and 46.4 degrees Fahrenheit at all times or it would go bad

The CDC and Walgreens used UPS’ technologically-advanced “Temperature True service” to deliver the medicine in temperature-controlled containers directly to the doors of the Laotian Health Ministry. The containers have high-tech environmental sensors and GPS/GSM communications capabilities to ensure that the medicine is kept at the right temperature and is being moved to the right place.

To date, the program has provided critically-needed flu vaccine medication to Laos, Nicaragua, Uganda and is helping those countries avoid potential pandemics.

**Sources:**

Weil, Marty. "Healthcare Logistics Gets a Shot in the Arm." *Inbound Logistics* August 2013.

"Influenza (Seasonal) Fact Sheet No. 211." *World Health Organization*. March 2014. Web. 30 May 2014.

"Prevent Spoilage Pharmaceuticals and Biotech." *UPS Temperature True: UPS*. Web. 01 June 2014.



### **Case Study 3: Beyond Borders: Conveyor System is Center of Coca-Cola Romania's Mega Warehouse**

*Suggested Text Topic:* Ch. 6, "Fundamentals of Mechanics"

Romanians, like Americans, like their Coca-Cola. In fact, in 2013 alone the company sold 148.5 million cases of Coca-Cola products including sodas and juices to thirsty Romanians. The country ranked third in emerging market sales behind only Russia and Nigeria.

In order to more efficiently move its fast-selling product, Coca-Cola knew it needed to build a larger and more technologically-advanced storage facility. The company bottles its products at three Romanian plants and utilizes 20 warehouses for distribution. The Coca-Cola Hellenic Bottling Company S.A. contracted a U.K.-based consulting firm, Total Logistics, to develop a new high-tech storage and distribution facility as part of the company's bottling plant in

Ploiesti, which is Coca-Cola's largest in southeastern Europe. After evaluating the firm's product storage process, Total Logistics created an automated high-bay mega warehouse which relies heavily on a primary conveyor system. After being bottled, the products are put on pallets and the conveyor system rapidly moves the palletized products into a bay large enough to hold 35,000 pallets. Eleven automated cranes are programmed to efficiently retrieve the pallets as needed for distribution.

The Ploiesti location opened in October 2009 and is the first of its kind in the country. The main conveyor system can move up to 290 pallets per hour from bottling into the storage area and almost double that (490 pallets per hour) from storage out for distribution to its more than 64,000 customers across the country.

#### **Sources:**

"Coca-Cola Hellenic Case Study." *Supply Chain Consultants Total Logistics The Complete Supply*

*Chain Consultancy UK RSS*. N.p., n.d. Web. 13 May 2014.

Popescu, Irina. "Coca-Cola's Sales Down in Romania in 2013, but Double Digit Increase on Juice Sales." *Romania-Insider* February 17, 2014.

Coca-Cola Company. News. *Coca-Cola System Invests €22 Million in New Romanian Cappy Pulpy Bottling Line*. Coca-Cola Company, 30 Oct. 2013. Web. 2 May 2014.



## **Case Study 4: Beyond Borders: Nike Utilizes Long Loop Sorter Technology to Better Serve Customers in EMEA Region**

*Suggested Text Topic: Ch. 5, "Material Handling"*

Tucked in a small suburb of Antwerp, Belgium is one of the largest and most highly-sophisticated high bay warehouses and distribution centers (DCs) in the world. Seattle-based sports apparel and shoe titan Nike uses the 30,000 square meter facility, dubbed the "Nike Logistics Centre of Excellence," to serve its base of customers across Europe, the Middle East and Africa (EMEA). In 2011 alone, sales in the EMEA region accounted for approximately \$4.8 billion in revenue or 27% of total Nike brand revenue, making it the second largest region for corporate sales.

According to the global material handling systems provider Vanderlande Industries B.V., Nike's material handling system handles a total assortment of 25,000 different products and 34 million items annually. The

heart of the system is a 280 meter long loop sorter, which handles both automated inbound and outbound cartons at a capacity of 6,000 items per hour.

Without the long loop sorter technology the process of sorting Nike's products such as footballs and sport bags would take significantly longer and reduce the company's overall efficiency and profitability. Regular maintenance and speedy repair of the long loop sorter is critical to moving high volumes through the facility and out to customers daily.

### **Sources:**

"Automated Warehouse for Equipment Supports Nike's Performance." *Vanderlande*. Vanderlande Industries, n.d. Web. 02 May 2014.

*We Think Different*. Rep. Somerset, New Jersey: Beumer Group, August 2012. Web. 03 May 2014.

"Nike, Inc. Revenue Performance Fiscal Years 2007 - 2011." U.S. Securities and Exchange Commission (SEC), 31 May 2011. Web. 22 May 2014.

## **Case Study 5: What Would You Do? New Inventory Control System Thwarts Thieves**

*Suggested Text Topics:* Ch. 3, “Supply Chain Principles”; Chapter 10, “Scanning and Optical Sensors”

When Ioma Industrial Enterprises management told its warehouse staff that it was introducing new technology to manage inventory, workers grumbled. Older workers objected to a new system thinking the current procedures worked well. Newer workers were more open, but were concerned the technology could eventually eliminate their jobs.

One of the first inventory control technologies the company introduced was computerized check-in of parts from suppliers. Before the new system, Ioma warehouse workers would simply verify items offloaded from trucks by manually filling out paper invoices and then leaving signed copies for eventual filing in the back office. However a company audit

revealed significant human errors and unaccounted loss in the paper-based check-in process which cost the company tens of thousands of dollars.

Sitting through the first day of training, Nathan became interested in learning how the new check-in process worked. Now, instead of just signing for the delivered materials, the receiving Ioma staffer would be required to place computer barcodes on each piece and then scan it which automatically entered the item into a new computerized inventory control system. The barcode tracking software would enable management to know where a part was in the supply chain at any point in time.

During a break, Nathan overheard two employees talking. He slowed down when he recognized his supervisor’s voice. “How are we going to get the stuff out now that we have to code everything? Before we could just take the stuff and then label a shrink-wrapped pallet of empty boxes and put it in back in deep storage, but if we have to label each piece with



that barcode we're not going to be able to do that anymore." Nathan realized that something he suspected was true. Occasionally he noticed some guys in receiving throwing parts off to the side after signing for them. He wondered why they weren't going into standard company bins for storage in the warehouse. They were stealing the items and storing empty boxes. For all he knew, they could even be re-selling the stolen parts to the company!

Nathan knew they wouldn't be able to keep up the scam with the new barcode system but wondered if he should tell his supervisor's boss about the conversation he overheard and what he noticed at the loading dock. His supervisor was nearing retirement and the system would probably fix the problem anyway so the theft would stop. What do you think Nathan should do? Why?

## **Case Study 6: Think Green: Safe Lubricant Disposal Saves Time, Money, Environment**

*Suggested Text Topic:* Ch. 6, “Fundamentals of Mechanics”

Supply chain technicians are typically responsible for lubricating machinery as part of predictive or preventative maintenance to ensure optimum efficiency in any automated warehouse or distribution center. However, safe disposal of the oil used for lubricating machinery is also important. With increased focus on environmental issues companies are now more aware of the environmental impact of waste oil and are looking for ways to reduce that impact.

The U.S. Environmental Protection Agency (EPA) defines used or waste oil as “any oil that has been refined from crude oil, or any synthetic oil that has been used and as a result is contaminated by physical or chemical impurities.” While most oil used to

lubricate warehouse machinery is non-hazardous it cannot simply be thrown out.

One way warehouses can be more environmentally friendly is by collecting the oil used in machinery lubrication to be recycled or re-refined. Used oil can be collected and recycled multiple times. In fact, according to the EPA, approximately 380 million gallons of used oil are recycled each year in the U.S. Within the supply chain industry, warehouses can filter and recycle certain oils used as machinery lubricants on site or through an energy recycling firm, saving time and money, and reducing companies’ environmental impact.

Every year *Inbound Logistics* recognizes 75 firms across the U.S. as Green Supply Chain Partners (G75) in the logistics and transportation field. Firms are chosen based on their environmentally-sustainable initiatives and leadership. Each year several firms including supply chain companies and 3PL (third party logistics providers) are recognized for their used oil

waste-reduction efforts including recycling and re-refining.

**Sources:**

“Managing Used Oil: Advice for Small Businesses EPA530-F-96-004.” *U.S. Environmental Protection Agency, Solid Waste and Emergency Response*. November 1996.

“G75: 75 Green Supply Chain Partners.” *Inbound Logistics* June 2013.



## **Case Study 7: Leading the Way: Cardinal Health Offers Customized Distribution for Healthcare**

**Providers** *Suggested Text Topics:* Ch. 6, “Fundamentals of Mechanics”; Ch. 3 “Supply Chain Principles”

Headquartered in Dublin, Ohio, Cardinal Health Inc. is the leading provider of products and services across the healthcare supply chain with more than \$70 billion in annual sales. The firm is able to customize distribution of pharmaceutical and medical products for firms working at every point on the healthcare spectrum – from emergency rooms to physician’s offices - across the U.S. through its network of 39 distribution centers. Every day Cardinal Health workers are able to ship out more than 200,000 types of medical products from over 2,200 manufacturers to their customer base of more than 50,000 organizations. In fact, the company is able to provide next-day delivery of medical products and drugs to more than 30,000 locations!

The firm’s ability to fulfill orders so rapidly across such a large market is due in large part to the supply chain technology it employs such as the Automated Inventory Management System (AIMS) it uses in its warehouses. Cardinal Health customized the Automated Inventory Management System (AIMS) product to receive, inventory, store, and ship all types of medical products. Computerworld magazine recognized AIMS with its “Best in Class Award.”

AIMS enables the firm to more quickly and efficiently move products through its five “mega-hubs” to its distribution centers nationwide which is critical when people’s lives are at stake. The firm’s hub in Waukegan, Illinois alone features four miles of conveyor systems, 180 lift trucks and power equipment to transfer supplies, and a fully visible computerized inventory system which utilizes Radio Frequency Identification (RFID) and bar coding technology.

Cardinal has built on its supply chain success by also acting as a third party logistics (3PL) provider for other companies. Through its Integrated Logistics Services division, the company provides medical manufacturers with a turnkey solution for outsourcing all or portions of its supply chain such as warehousing and transportation. In this way manufacturers can focus on producing medical equipment and drugs and Cardinal Health can ensure the effective, safe delivery of those products to end users.

**Sources:**

"Cardinal Health Sharpens Customer Focus, Operational Efficiency by Creating \$70 Billion Supply Chain Services Unit." *Free Online Library*. Cardinal Health, Inc. Web. 14 May 2014.

"Distribution Services." Cardinal Health, n.d. Web. 17 May 2014.

Barrett, George. "New Cardinal Health." PowerPoint Presentation. 14 January 2009. Web. 6 June 2014.

## **Case Study 8: Turning a Corner with Technology: Sierra Marine Charts New Course with CipherLab Scanners**

*Suggested Text Topic:* Ch. 10, “Scanning and Optical Sensors”

For nearly 40 years Sierra Marine, based outside Chicago, has been the leading manufacturer and supplier of marine engine and drive parts. As an engine parts aftermarket division of SeaStar Solutions, the company offers more than 6,000 products in the U.S. as well as Europe through its distribution center in Holland.

As the company expanded its warehouse, workers’ old handheld scanners, which had short wireless range, could no longer keep up with demand. Real-time inventory control was suffering as workers shuttled back and forth between computerized scanners and manual data entry.

The company worked with an outside consulting firm, eComputer, to develop a solution. By switching to a new cordless 1166 Bluetooth® scanner from Taiwan-based CipherLab, Sierra Marine workers were able to more quickly and reliably scan barcodes for inventory. Even if workers were beyond wireless range the new technology acquired up to 256 data scans to be automatically uploaded when back within coverage.

The scanner’s open-source architecture paired with in-house software at Sierra Marine not only enables workers to save time by instantaneously managing inventory but it also saves the firm money by minimizing over- or under-stocking.

### **Sources:**

"CipherLab Scanners Sink Competition at Sierra Marine." *CipherLab*. CipherLab, n.d. Web. 29 Apr. 2014.

"Sierra Engine and Drive Parts FAQ's." *SeaStar Solutions*. SeaStar Solutions, n.d. Web. 16 May 2014.

"General Cordless Scanner 1166 Bluetooth®  
ScannerWireless Linear Imaging Scanner." *CipherLab:  
1166 Bluetooth Scanner*. CipherLab, n.d. Web. 21 May  
2014.



## **Case Study 9: Leading the Way: Sysco Utilizes Warehouse Technology to Keep Customers Safe**

*Suggested Text Topic:* Ch. 6, “Supply Chain Principles”

Next time you sit down to eat there’s a good chance something on the table was shipped by Sysco. Sysco is a Houston-based food distributor that annually ensures 21.5 million tons of food makes it quickly and safely from producers to consumers. In fact, one out of every three restaurants, cafeterias and sports stadiums in the U.S. – or one-quarter of the entire American market - serve food and food products from Sysco.

Sysco utilizes 193 distribution centers across the U.S. A key feature of Sysco’s warehouse technology is bar coding all food and restaurant products. The bar coding ensures that Sysco knows exactly how much stock it has in its warehouse at any point in time and also allows the company to assign expiration dates to every single piece of inventory – even non-perishable items!

In addition to helping the company track where inventory is going, it helps Sysco keep track of which products are provided by all of their individual vendors. This technology can assist in emergency situations, such as helping prevent the spread of food-related disease. When the Food and Drug Administration ordered the recall of salmonella-contaminated peanut products supplied by Peanut Corp. of America in 2008, Sysco was able to notify the FDA that six of its vendors could also have potentially tainted goods. In the May 27, 2009 *Fortune* magazine article “Veggie Tales,” writer Jia Lynn Yang wrote, “The company says it also used its tracking software to help the FDA investigate the sources of contamination by triangulating information about its shipments, eateries that had reported outbreaks, and the suspected ingredients. Using that kind of information, Sysco also helped health officials identify sources of contamination during the 2006 spinach E. coli outbreak.”

## **Sources:**

Yang, Jia Lynn. "Veggie Tales." *CNNMoney*. Cable News Network, 27 May 2009. Web. 19 May 2014.

"Meal Deal." *The Economist*. The Economist Newspaper, 14 Dec. 2013. Web. 14 May 2014.

"Sysco | Customer Solutions." *Customer Solutions*. Sysco, n.d. Web. 30 Apr. 2014.

## **Case Study 10: Turning a Corner with Technology: Diapers.Com Leaves the Roaming to Robots**

*Suggested Text Topic:* Ch. 9, “Programmable Logic Controller Basics”

The folks at Diapers.com know you don’t mess with tired moms. That’s why when the e-commerce company began growing out of its home-based operations it opted for the most technologically advanced tools to fulfill customer orders. The company delivers every possible type of product for infants through toddlers to customers nationwide six days a week. The company uses three fulfillment centers to pack and ship items to customers, guaranteed to arrive in two days or less.

When you visit a Diapers.com fulfillment center your first impression may be that it’s filled with moving shelves. No, that’s not an illusion. It’s the Kiva robotics system which the company uses to more quickly assist workers in picking, packing, and shipping

orders. Instead of workers walking through warehouses to find items or waiting for them to arrive on conveyors, robotic drive units physically move items to the workers’ stations. Once there, the workers are digitally directed by the system to know which items to pick, pack and then send back on the system once the order is complete. The Kiva system continues to move completed orders through packaging, taping and even on to the truck itself for transportation from the warehouse to waiting moms.

The company’s staff credits the Kiva system, including the optical scanning equipment, with improving accuracy and speed, two definite competitive advantages in the cut-throat baby product business. The investment in the high-tech system paid off in 2010 when the king of e-commerce, Amazon, purchased Diapers.com for \$540 million.

### **Sources:**

"Diapers.com DC Case Study." *Kiva Systems Resources*. Kiva Systems, n.d. Web. 14 May 2014.

Siriwardane, Venuri. "Diapers.com with \$180M in Annual Sales to Launch Soap.com." *The Star-Ledger*. 7 June 2010.

Aune, Sean. "Amazon to Acquire Diapers.com for \$540 Million." *TechnoBuffalo.com*. 8 November 2010. Web. 13 May 2014.

Coster, Helen. "Diapers.com Rocks Online Retailing." *Forbes.com*. 8 April 2010. Web. 19 May 2014.

## **Case Study 11: Turning the Corner with Technology: Global Chocolate Producer Finds Sweet Satisfaction with New Warehouse Automation**

*Suggested Text Topic:* Ch. 6, “Fundamentals of Mechanics”

For world-renowned chocolate producer Lindt & Sprungli, a new waveless picking and warehouse automation expansion produced sweet results. The confectionary king, which has been in business for more than 165 years, faced significant business challenges including new government regulations and customer labeling demands as well as growing volume. Realizing it needed to make major changes at its Stratham, New Hampshire distribution center in 2007, the company chose Invata Intralogistics’s *Fasttrak®* warehouse software and control system as part of a new building project.

Pallets of the company’s delicious chocolate products are sent into the warehouse on a pallet conveyor. They are then transferred to a high-bay storage and retrieval area and inventory lots are bar-coded and scanned to ensure fresh chocolate for each waiting customer. Once orders begin, so does the waveless picking process.

Waveless picking is a newer approach to managing inventory orders. Instead of sending order information in “waves,” the waveless process allows for a more dynamic, real-time order fulfillment process so workers aren’t experiencing downtimes between waves and warehouse conditions can release new orders as finished orders are completed. The *Fasttrak®* system features an extensive conveyor system with 12 different types of conveyors, a sliding shoe sortation system with 13 separate lanes and specialized software that enables the company to easily and instantaneously compare current inventory to incoming orders. Product is moved at more than 100 packages



per minute speed along the miles of conveyor belts in the automated warehouse. At the end of the process digital display boards direct workers as to how to best build pallets from completed orders.

Today the company continues to enjoy serving loyal customers in 120 countries and is realizing rich profits.

**Sources:**

“Waveless Picking Sweetens Bottom Line.” *Invata Intralogistics Case Study*. Invata Intralogistics, n.d. Web. 9 May 2014.

*Lindt & Sprungli Annual Report 2013*. Rep. Zurich: Chocoladefabriken Lindt & Sprungli AG, 2014. Web. 15 May 2014.

**Case Study 12: Think Green: Wal-Mart Designs Canadian Distribution Center to Save Costs, Increase Sustainability** *Suggested Text Topic: Ch. 7, “Electrical”*

As the largest retailer on the planet, Wal-Mart is well known for creating profits by keeping costs under control. A significant cost for the company is energy. In 2010 it opened a new \$115 million state-of-the art sustainable distribution center in Western Canada designed specifically to reduce energy costs and at the same time reduce the company’s environmental impact.

The 400,000 square foot warehouse in Alberta is a fresh and frozen food distribution center that serves 104 retail outlets in the surrounding region. Instead of relying solely on petroleum-based energy sources, the company generates electricity from solar panels and two, 30-kilowatt wind turbines on site. The turbines generate about 100,000 kWh per year which is roughly equivalent to the amount of power used by 40

average-sized Canadian homes annually. Inside the building the workspace is illuminated by solid-state light-emitting diode (LED) lights which not only save money but produce less heat than traditional fluorescent lighting which lowers energy required to cool the refrigerated facility.

In addition, the entire fleet of 71 lift trucks and material handling vehicles used to move inventory around the warehouse to packing and distribution points are now powered by hydrogen fuel cells. The new technology allows warehouse workers to recharge trucks during operation onsite.

New high-efficiency dock doors and doorways feature electronic monitoring to ensure that doors are not left open unnecessarily, requiring additional electricity generation to maintain the required internal temperature for inventory.

**Sources:**

Walmart. News. *Walmart Canada Opens Its First Sustainable Distribution Centre. Walmart.com.*

Walmart, 10 November 2010. Web. 27 May 2014.

“A Peek Inside Wal-Mart Canada’s ‘Green’ Distribution Center.” *Supply Chain Quarterly*. Quarter 1, 2012.

Web. 17 May 2014.

## **Case Study 13: Thinking Green: Electronic Parts Distributor Models Energy Efficiency**

*Suggested Text Topic:* Ch. 7, “Electrical”

Creating a new integrated production and logistics facility wasn’t the most challenging project for Avnet, a Fortune 500 company and \$16 billion global leader in electronic components and computer product distribution. Making it a model of cost-efficiency and warehouse sustainability was.

In 2008 the firm opened a state-of-the-art Global Solutions Center in Chandler, Arizona just outside of Phoenix. The 320 Avnet workers at the 228,000 square foot facility build and ship more than 700,000 systems yearly. Material handling systems are set up in convenient configuration to ensure seamless movement between production and shipping. Workers take direction from a computerized warehouse management system and then remotely guide Hyster

pickers through aisles to select bar-coded products to fulfill orders.

The Center’s efficiency is matched by its environmental friendliness. The building meets the Leadership in Energy & Environmental Design (LEED) Silver standards and features high-density insulation and windows with high UV coatings to reduce heating and cooling costs. Programmed systems automatically turn off lighting in unused areas to further reduce electrical demand. Recycling efforts involve nearly a ton of cardboard daily and finding a way to transfer foam to a local community organization needing the material for public school classrooms.

### **Sources:**

Bradley, Peter. “Avnet Goes Lean and Green.” *DCVelocity.com*. 24 February 2014. Web. 13 May 2014.

“Avnet Global Solutions Center.” *Avnet Technology Solutions Fact Sheet*. Avnet Technology Solutions, 2012. Web. 27 April 2014.

## **Case Study 14: What Would You Do?: Covering Up After a Hazardous Material Container Mishap**

*Suggested Text Topic: Ch. 4, "Safety"*

When Carlos' family moved to a suburb in the Midwest he was glad to get work at a regional car parts production and distribution center. As part of employee orientation, workers were required to complete training on hazardous materials storage and disposal. The company stated that it complied with Occupational Safety and Health Administration (OSHA) requirements including maintaining Safety Data Sheets (SDS) for each chemical that workers could be exposed to in the facility. The SDS provided instructions that workers were expected to follow for handling chemical products including the company's spill control plan.

One day after being on the job for several months Carlos heard yelling on the warehouse floor. He joined a few other workers who raced over to see acetone

pouring out of a storage container that a forklift operator had accidentally pierced when taking a corner too quickly. Carlos knew the liquid was extremely flammable. The spill was cleaned up and Carlos headed back to performing conveyor maintenance.

The next day Carlos' supervisor called a team meeting of all the workers who had been on the floor when the forklift accident occurred. Looking tired and anxious he explained that the acetone should not have been in that location on the warehouse floor and worse, it had been incorrectly stored in an unauthorized container. The firm's insurance required that Class IB flammable liquids be stored in Underwriter Laboratory (UL) approved safety cans. Sheepishly, the supervisor admitted that he should have caught and fixed the error before the accident had occurred. Because all of the workers present at the accident site would be required to sign an accident report he hinted that he would appreciate it if everyone went along with the



report he was planning to file indicating that the acetone was in the proper container and had just been moved to that spot temporarily that day. Carlos didn't feel comfortable signing a document that he knew wasn't factually correct but at the same time the accident didn't cause any damage to anyone or anything as far as he could tell. What do you think Carlos should do? Why?

**Sources:**

National Institute of Occupational Safety & Health, Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services. (Washington: GPO 2005)

National Fire Protection Association, Flammable and Combustible Liquids Code Handbook, Sixth edition, ed. Robert Benedetti, 1996.

National Institute of Occupational Safety & Health, Pocket Guide to Worker Safety Series: Warehousing,

U.S. Department of Health and Human Services.  
(Washington: GPO 2004)

## **Case Study 15: Turning a Corner with Technology: Case Picking System More Efficiently Packs Pallets of Beer Cases**

*Suggested Text Topic: Ch. 5, "Material Handling"*

In 2011, Straub Distribution Company, one of the nation's top Anheuser Busch distributors, implemented a new case picking system in its facility in Anaheim, California. The system was designed to reduce labor cost in the warehouse and on the road. The system is a mix of both semi-automated and automated technology.

The Vertique system features storage towers which are hand loaded by Straub's case pickers. Before, case pickers had to actually move around the warehouse, locate appropriate cases, and then stack product on the pallet. Today, the sorting of products is done automatically in the system's "mixing center." Once released into the mixing center, products are merged and mixed into the proper order for the proper pallet to

be placed on the proper truck. The mixing center is powered by an industry-leading VPS pallet building software. Products are placed on the pallet by the system's fully-automated high level palletizer. The palletizer utilizes robotics to form the layers of product and then places the layers on the pallet. The pallets are then stretch wrapped and loaded onto trucks. By only wrapping pallets that are stacked over 3 layers high, the company saves time and money in shrink wrap cost. Finally, all of these smaller pallets go onto side load trucks.

Before the installation of the Vertique system, only 30% of Straub's orders were "picked to order." Today, almost 100% of the company's orders are. Prior to the implementation of the Vertique system, loads were difficult to have ready-picked for drivers and overtime costs sky rocketed in the warehouse. With the installation of the Vertique system...overtime decreased from an average of 160 hours a week to

less than 10. Saving money and time with a new automated system has been a big success for Straub.

**Source:**

“The Vertique System at Straub.” *ITW Warehouse Automation Customer Testimonial*. ITW Warehouse Automation, n.d. Web. 11 June 2014.

## **Case Study 16: Thinking Green: Renovating a Warehouse with the Planet in Mind**

*Suggested Text Topic:* Ch. 6, “Fundamentals of Mechanics”

When Autopart International (API) contracted with materials management solution provider Abel Womack to renovate its existing warehouse in Norton, Massachusetts the company was migrating the activities of 4 existing API warehouses into one centralized location. From that location API would distribute auto and truck parts and accessories to clients throughout the U.S.

To accommodate API’s needs, Abel Womack designed and installed conveyor and storage systems which enabled more effective management and store parts inventory as well as greater efficiency in preparing customer orders and ensuring same-day shipping.

Energy efficient “green” technology systems were a priority for the project. Voice-directed picking software

allowed the distribution center to go paperless. Most items are shipped in pick totes and then recycled, a process which reduced the company’s need for corrugated packaging. Lastly, the company employed new energy-efficient equipment including Raymond lift trucks which are up to 33% more energy-efficient than other similar pieces of equipment, Hytrol conveyors, an Automotion shipping sorter and automatic zone transfers.

### **Source:**

“Green Technology Improves Warehouse Efficiency.”  
*Abel Womack Case Study – Autopark International, Norton, MA, Distribution Center Renovation.* Abel Womack, n.d. Web. 13 June 2014.

## **Case Study 17: Beyond Borders: Warehouse Automation Essential When Working with Vendors from the Far East**

*Suggested Text Topic:* Ch. 10, “Scanning and Optical Sensors”

Barrow Industries is a leading designer, importer, and supplier of fabric to a wide range of customers that includes retailers, furniture manufacturers, and designers. Much of their product line is imported from the Far East. They sell a fashion product and having long delivery lead times from overseas means that there is little margin for error in replenishing inventory.

The company employs nearly 300 people worldwide and operates a 275,000 square foot warehouse outside Atlanta, Georgia. The company implemented Expertek’s NxTrend SX.enterprise System to automate the warehouse. By doing so, Barrow has been able to eliminate most of the paperwork through the use of RF (radio frequency) terminals. In the Expertek case study

Barrow Executive Vice President Gary Sweeney notes “The system tracks all product movements through the warehouse, (so)...product can now be stocked in any location, and the system always knows where it is. That allows us to utilize space more efficiently and to save time locating product.”

As a fabric supplier, having visibility to pieces and sizes of pieces in inventory is critical. Barrow’s previous system kept track of total yardage, but gave employees no visibility to what was actually in inventory for pieces. This situation created problems for customer service, since it was not always possible to know if they had the right piece size to fill an order. Additionally, management had no way to track remnant pieces. Their ability to track and liquidate those pieces has improved considerably.

“In our old system, we printed extensive replenishment reports on green-bar paper on a nightly basis that were used by our buyers to reorder product,” stated Gary. “These reports provided too

much information in some cases and not enough in others. With the new system, all of that information is accessible online. Our buyers can compare product supply with demand interactively side-by-side and can drill down into detailed information when they need it. Furthermore, the system tracks what has been reviewed and calls attention to what products need immediate attention. Having this information has allowed us to keep a tight rein on inventory and minimize costly air freight charges.”

**Source:**

“Covering their Bases with SX.enterprise and Expertek Systems.” *Expertek Case Study*. expertek, n.d. 2 June 2014.



## **Case Study 18: Leading the Way: Trident Seafoods**

*Suggested Text Topic:* Ch. 10, “Scanning and Optical Sensors”

One of the hardest things about being a seafood business is the sheer size and unpredictability of inventory sourcing. Trident Seafoods, one of the largest seafood businesses in the U.S. spans the spectrum of seafood production from fishing to processing to value-added manufacturing. To get a better grip on its inventory and transactions from its home base of operations in Alaska the firm implemented a barcode scanning and data collection system to upload information about catches to its business software.

Using the RFgen mobile data collection system Trident employees in the field or at processing plants can scan information about product being readied to ship from the Bering Sea to the company’s manufacturing plants in Minnesota, Oregon and Washington and then

on to customers worldwide. Employees barcode and scan the harvested fish, adding to the company’s online inventory system before placing the fish into storage freezers. They can also use the system to record which items they used to make their value-added products such as glazed salmon and parmesan encrusted tilapia. Stored, frozen products are then moved to staging where they will be palletized or placed in containers, labeled and shipped.

One of the main benefits of the RFgen mobile collection system for Trident is that it continues storing scanned, captured information even if network connections are lost which is not uncommon when dealing with the company’s remote plant location. The company can even use the RFgen equipment to customize labeling on pallets for customers. With one scan of the label, the receiving company knows everything about all the items on the pallet, making it easier to inventory and store the Trident products.

Using the mobile collection tools and software the company greatly increased its outputting speed, nearly tripling its transaction volume and keeping seafood aficionados worldwide happy.

**Source:**

“One of the Nation's Largest Seafood Companies Uses RFgen to Improve Efficiency of Inventory and Manufacturing Transactions.” *RFgen Software Case Study*. RFgen, n.d. 15 June 2014.

## **Case Study 19: What Would You Do?: Coming Truthful with a Client or Covering Up for a Loyal Employee?**

*Suggested Text Topics:* Ch. 5, “Material Handling”; Ch. 13, “Workplace Communication”

Ross had been working for Gulf Stream Industries for 10 years. After going through a severe financial downturn the company was sold to a competitor that didn't have as much experience managing a firm of Gulf Stream's size. Ross had kept his job as supervisor but had to cut back on staffing after the company lost out on several contracts it had projected to win. In addition to reactive and preventive maintenance his team had always been responsible for predictive maintenance of the machinery, testing and monitoring all of the firm's machinery in order to predict and avert major system failures.

One of Ross' best workers, Charley, had been with the company for 24 years and was nearing retirement.

Charley was a good, dependable worker. However after the change in ownership and cutbacks in staffing, Charley was taking on a lot more work than usual. Instead of regularly walking the floor and doing sight and sound analysis on conveyor and sorter systems he spent most of his time doing immediate repair work.

One afternoon the main conveyor system broke down in the middle of a critical order fulfillment. Gulf Stream had been fortunate to keep this client during the company's ownership change and in fact had been “put on notice” that nothing could go wrong with this fulfillment if it expected to keep the contract. Ross pulled several men from other parts of the warehouse to work on the conveyor repair which was far more extensive than he had anticipated when he first got the call from Charley. Walking over to check on the work team Ross noticed that a meter module attached to the system was off. The module was set so that if a meter reading was off – meaning its numbers were

outside the desired range – Charley would know to issue a work order to do proactive maintenance.

It took Charley's team nearly one full day to complete the needed repair. When he met with Charley after the system was back up and running, Ross asked Charley about the meter. Charley looked a little surprised and embarrassed. He stumbled for a minute and then confessed that he turned it off. When Ross asked why, Charley said that he didn't have the crew or the time to keep up with all the reactive maintenance, much less predictive work. Ross had to decide – should he report and penalize Charley for contributing to the mechanical breakdown or just tell the client that it was unavoidable system failure? What do you think Ross should do? Why?

**Source:**

“Predictive and Preventive Maintenance Improve Asset Management.” *Sprocket CMMS Blog*. Sprocket Dematic, n.d. 15 June 2014.

## **Case Study 20: What Would You Do? When Inadequate Training Creates an Accident**

*Suggested Text Topic: Ch. 4, "Safety"*

According to OSHA every year approximately 85 warehouse technicians are killed in fatal forklift accidents and nearly 35,000 are seriously injured. Forklifts are considered "powered industrial trucks" (PITs) and OSHA clearly outlines PIT training regulations. Companies are required to train drivers on each type of PIT they are assigned to operate and document training and re-certification every three years.

Harold had worked for Xpress Logistics for a little over a year and had a perfect safety record driving a forklift moving wood pallets. The firm was growing quickly as a result of the local port expanding. As a result was having a hard time hiring and training enough workers on PITs to keep pace with incoming shipments that required quick turnaround time.

Shortly after starting his shift one day Harold's boss pulled him off the floor and told him he was going to be driving a forklift with a drum attachment. He took Harold back into the warehouse and had him sit on the new machine, pointing out controls for manipulating the clamping mechanism. He told him to watch one of his co-workers operate a similar machine and then begin moving fiber drums of small metal parts regularly ordered by a local manufacturing plant.

A few weeks after starting on the new PIT Harold had his first accident, dropping a drum which burst and sent metal pieces flying. A co-worker's leg was severely cut by one of the metal shards and he required surgery which meant workman's comp for the company. When the insurance company representative came to the warehouse he asked to meet with Harold separately about the incident. While waiting Harold noticed that the papers on the table stated that he had "received thorough training (on the forklift with the new drum attachment) in an area separate from other

workplace activities and personnel and under direct supervision of a trainer.” It was signed by his boss and had another apparent signature scrawled with his name underneath.

Harold had to decide – should he tell the investigator that his signature had been forged and that he had not received directly-supervised, adequate training? Or should he wait and see if it came up in conversation and hope that it didn’t? He knew that doing so could mean the insurance company wouldn’t have to cover the medical costs for his co-worker leaving his company to foot the bill. What do you think Harold should do? Why?

**Sources:**

“Eagle-Grip™ Drum Attachments.” Easy Lift Equipment Co., Inc. Web. 9 August 2014

“Rigid Industrial Packaging: Fibre Drums.” Greif. Web. 1 August 2014.

“Powered Industrial Truck Operator Training; Final Rule.” U.S. Department of Labor Occupational Safety & Health Administration (OSHA). 1998. Web. 30 July 2014.

## **Case Study 21: What to Do When a Medical Incident Could Mean Losing a Job**

*Suggested Text Topic:* Ch. 4, “Safety”

Wade was thrilled to get work as a technician at the new distribution center that opened in the town next to his. He had spent the last three years after high school working a variety of jobs, often requiring long commutes because there were so few employers in his small rural home town.

During new employee orientation his supervisor explained the company’s policy on personal protective equipment (PPE). Failure to properly use all PPE was grounds for immediate dismissal. The company issued all the PPE required for the position and provided lockers for the workers to store the equipment when they weren’t working.

His second week on the job Wade absent-mindedly put his company-issued gloves in his pocket after clocking out and then forgot to bring them back to

work the following day. Because he was already running late and didn’t have time to run back home to get them, he quickly fished another pair of gloves out of his truck and went to work. He knew they weren’t company-issued but figured it didn’t matter.

Shortly before his shift was over he accidentally sliced open his hand while trying to repair a belt unit on a cross-belt sorter. Knowing he wasn’t wearing the company-issued gloves he quickly pulled the gloves off and shoved them into his pocket before going to report the accident to his supervisor. After examining the sheared-off piece of metal that caused the injury Wade’s boss said he was surprised that it was sharp enough to cut through the top-of-the-line PPE. Knowing that telling the truth could mean potentially losing his job, Wade didn’t respond. As he was leaving to go to the nearest outpatient clinic to get the cut stitched up he saw a co-worker who laughed, knowing that Wade wasn’t wearing the company-issued gloves. What do you think Wade should do? Why?



**Source:**

“Occupational Safety and Health Standards: Personal Protective Equipment, General Requirements.” U.S. Department of Labor Occupational Safety & Health Administration (OSHA). 2011. Web. 2 August 2014.

“Intellisort® Sortation Solutions.” 2011. Intelligrated. Web. 28 July 2014.

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# Career Awareness Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. What is a Supply Chain Technician?

\_\_\_\_\_

2. What organization do the letters NCSCA indicate?

\_\_\_\_\_

3. What is the Supply Chain?

\_\_\_\_\_

4. What are the factors contributing to the adoption of automation in warehouse?

\_\_\_\_\_

5. What is the outlook for need for SCT's?

\_\_\_\_\_

6. What are seven of the skill sets proscribed in the NCSCA Model Program?

\_\_\_\_\_

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Career Awareness Solutions

1. What is a Supply Chain Technician?

**A person who installs, operates, supports, upgrades or maintains the automated material handling equipment and systems that support the supply chain.**

2. What organization do the letters NCSCA indicate?

**National Center for Supply Chain Automation**

3. What is the Supply Chain?

**People, processes, logistics, and technologies that bring any product from point A to you**

4. What are the factors contributing to the adoption of automation in warehouse?

**E-Commerce Growth, E-Commerce Order Size, Mass Customization, Re-Shoring, Consumer Safety, Cost Control & Competitiveness. Immediate Delivery, Flexibility**

5. What is the outlook for need for SCT's?

**Favorable-Answers may vary**

6. What are seven of the skill sets proscribed in the NCSCA Model Program?

**Answers may vary**

|                                         |                                                |
|-----------------------------------------|------------------------------------------------|
| <b>Intro to Automated Warehousing</b>   | <b>Overview of the Automated Warehouse</b>     |
| <b>Mechanics</b>                        | <b>General Mechanics</b>                       |
| <b>DC Electrical</b>                    | <b>Direct Current Theory and Service</b>       |
| <b>AC Electrical</b>                    | <b>Alternating Current Theory and Service</b>  |
| <b>Microprocessors/Microcontrollers</b> | <b>Microprocessing and Control Systems</b>     |
| <b>Technical Communications</b>         | <b>Business Documentation and Presentation</b> |
| <b>Blueprint Reading</b>                | <b>Study of Blueprints</b>                     |
| <b>Math</b>                             | <b>Math for Engineering Technology</b>         |
| <b>OSHA</b>                             | <b>Safety Standards for General Industry</b>   |
| <b>Hydraulics/Pneumatics</b>            | <b>Air and Fluid Power Basics</b>              |
| <b>Welding</b>                          | <b>Welding Basics</b>                          |
| <b>Logic Controllers</b>                | <b>PLC Theory and Maintenance</b>              |

# Industry Certification Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. What is the Manufacturing Skill Standards Council (MSSC)?

\_\_\_\_\_

2. Name the production modules needed for certification.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Name the three major types of industry certification.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. Which two certifications are approved by the ISO?

\_\_\_\_\_

\_\_\_\_\_

5. Name Three Certified Logistics Associate's key work activities.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6. Name Three Certified Logistics Technician's key work activities.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_



# Industry Certification Solutions

1. What is the Manufacturing Skill Standards Council (MSSC)?

**Manufacturing Skill Standards Council (MSSC), a 501(c)3 non-profit, is an industry-led, training, assessment and certification system focused on the core skills and knowledge needed by the nation's front-line production and material handling workers. The nationwide MSSC System, based upon industry-defined and federally-endorsed standards, offers both entry-level and incumbent workers the opportunity to demonstrate that they have acquired the skills increasingly needed in the technology-intensive jobs of the 21st century.**

2. Name the production modules needed for certification.

**Safety; Quality Practices & Measurement; Manufacturing Processes & Production; Maintenance Awareness; Green Production**

3. Name the three major types of industry certification.

**Certified Production Technician (CPT)**

**Certified Logistics Technician (CLT)**

**Certified Logistics Associate (CLA)**

4. Which two certifications are approved by the ISO?

**CLT and CPT**

5. Name three Certified Logistics Associate's key work activities.

**Demonstrate an understanding of the various roles in the global supply chain logistics life cycle**

**Demonstrate an understanding of the logistics environment**

**Operate and use equipment**

**Practice safety principles**

**Practice safety principles in the handling of materials and operation of equipment**

**Practice quality control principles**

**Employ good work communication practices**

**Practice teamwork and good workplace behavior to solve problems**

**Use relevant computer systems and applications to increase productivity**

6. Name three Certified Logistics Technician's key work activities.

**Receive products**

**Stock products**

**Process product orders**

**Prepare packages for shipment and ship products**

**Maintain control of inventory**

**Handle hazardous materials in a safe manner**

**Perform dispatch, routing and tracking operations**

**Understand U.S. measurements and metric system conversions**

# Supply Chain Principles Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. What are the three major components of a supply chain?

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2. What is a Distribution Center?

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3. What is the relationship between “containerization” and “just in time”?

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4. Draw a simple supply chain diagram.

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_



# Supply Chain Principles Solutions

1. What are the three major components of a supply chain?

**Supply, Manufacturing and Distribution**

2. What is a Distribution Center?

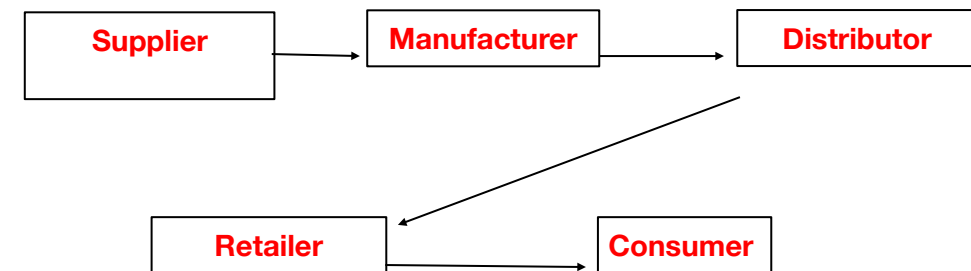
**Distribution centers are the foundation of a supply network, as they allow a single location to stock a vast number of products.**

3. What is the relationship between “containerization” and “just in time”?

**Containerization enables components to be transported cheaply and delivered "just-in-time."**

4. Draw a simple supply chain diagram.

**Answers may vary in design, but need the five components below.**



# Safety Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. Describe the process of Incident Reporting and what the process includes?

\_\_\_\_\_

2. What is OSHA?

\_\_\_\_\_

3. Name the examples of Personal Protection Equipment (PPE).

\_\_\_\_\_

4. Describe the meaning of four bars and the number system in the Hazardous Material Identification System.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. What are three basic types of fire extinguishers?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Safety Solutions

1. Describe the process of Incident Reporting and what the process includes?

**Incident Reporting is the overall collection of information on an incident that has an effect on personnel, equipment or deliverables. The process includes accident reporting, statement forms, equipment review forms and property damage reports.**

2. What is OSHA?

**The Occupational Safety and Health Administration is the most comprehensive and recognized federal agency that deals with all aspects of workplace safety. The regulations they provide are the standards and codes that are the most widespread in use and most other regulatory organizations must abide by their requirements.**

3. Name the examples of Personal Protection Equipment (PPE).

**Safety glasses, face shield, respirator, helmet, earplugs, safety shoes, gloves**

4. Describe the meaning of four bars and number system in the Hazardous Material Identification System.

**The four bars are used as symbols to identify different hazards: blue for health issues, red for flammability or fire issues, orange for physical hazards and white for personal protection. Each area includes a number system, ranging from 0-4, to identify the degree of risk. A higher number indicates a greater risk.**

5. What are three basic types of fire extinguishers?

**Water, Carbon Dioxide, and Dry Chemical**

# Facility Safety Evaluation

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. Tour the facility and during your evaluation find the location of the following items:

Fire extinguishers

MSDS folder

First aid kits

Evacuation plan postings

Guardrails or safety barriers

Eye wash station (if required)

Equipment access limitations (Floor striping or barriers)

Fall Protection equipment (on lifts)

2. List any safety items you feel have not been included or addressed during your evaluation.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. What items of Personal Protection Equipment should the employees at this facility wear?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. What type of fire extinguishers are used in the facility? (A, B, C, D)

Type\_\_\_\_\_

Inspection Date\_\_\_\_\_

5. Select an MSDS form from the posted folder and complete the following information.

Product name

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Chemical name

---

Flash point

---

pH \_\_\_\_\_ (7-neutral, above 7 caustic, below 7 acidic)

State of material \_\_\_\_\_ (solid, liquid, gas)

Instructor Grade \_\_\_\_\_

Date \_\_\_\_\_



# Facility Safety Evaluation Solutions

1. Tour the facility and during your evaluation find the location of the following items:

Fire extinguishers

MSDS folder

First aid kits

Evacuation plan postings

Guardrails or safety barriers

Eye wash station (if required)

Equipment access limitations (Floor striping or barriers)

Fall Protection equipment (on lifts)

2. List any safety items you feel have not been included or addressed during your evaluation.

**Answers can include injury plan, incident report form, emergency shut off devices, lockouts and tagouts, fire safety plan**

3. What items of Personal Protection Equipment should the employees at this facility wear?

**Answers can include safety glasses, face shields, respiration protection, head protection, hearing protection, foot protection, hand protection**

4. What type of fire extinguishers are used in the facility? (A, B, C, D)

Type\_\_\_\_\_

Inspection Date\_\_\_\_\_

5. Select an MSDS form from the posted folder and complete the following information.

Product name

---

Chemical name

---

Flash point

---

pH \_\_\_\_\_ (7-neutral, above 7 caustic, below 7 acidic)

State of material \_\_\_\_\_ (solid, liquid, gas)



# Mobility & Robotics Equipment Questions

Student  
Name\_\_\_\_\_

Date\_\_\_\_\_

1. Describe the primary function of each type of lifting truck.

Forklifts  
\_\_\_\_\_  
\_\_\_\_\_

Reach trucks  
\_\_\_\_\_  
\_\_\_\_\_

Order pickers  
\_\_\_\_\_  
\_\_\_\_\_

Swing-reach trucks  
\_\_\_\_\_  
\_\_\_\_\_

Transfer tugs  
\_\_\_\_\_  
\_\_\_\_\_

2. Describe each of the following devices used to move product and define the applications and advantages that each present.

Belt conveyor  
\_\_\_\_\_  
\_\_\_\_\_

Roller conveyor  
\_\_\_\_\_  
\_\_\_\_\_

Pulley

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3. Describe the basic function of robotics as it relates to the operation of the distribution center.

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4. Describe each of the predictive maintenance techniques.

Infrared thermography

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Vibration analysis

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Oil analysis

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---

5. Describe each of the following programing methods.

Pendent Programing

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Computer Controlled Programing

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Mobility & Robotics Equipment Solutions

1. Describe the primary function of each type of lifting truck

Forklifts: **Provide heavy lifting and moving of pallets within the warehouse. They are used to offload trailers on receiving docks and load trailers on shipping docks. The weight of the electronic truck batteries counter balances the weight of the materials being lifted.**

Reach trucks: **Possess multi-stage masts that lift lower heavy pallets into high bay storage racking above 30 feet in height. The operator remains at ground level allowing the efficient use of vertical space in the warehouse.**

Order pickers: **Raise the operator up to the level of pallets in high bay racking storage so that they can remove individual cases to fulfill less-than-pallet quantity orders.**

Swing-reach trucks: **Raise the operator and the pallet to the desired put-away or pick-up level. Use of these trucks allows rack aisles of smaller width by reducing pivot radii for the lifts.**

Transfer tugs: **Tow collections of flat carts for cost-efficient transportation of individual cases between areas within the**

**warehouse. They are frequently used to gather and move carts used by order pickers to fulfill numerous individual orders.**

2. Describe each of the following devices used to move product and define the applications and advantages that each present.

Belt conveyor: **Conveys unit loads in varying sizes, shapes and weights. The conveying medium is a flat belt which is capable of carrying loads over long distances with a single drive motor. It's the least expensive and simplest of the options.**

Roller conveyor: **Allows accumulation of lots of product throughout the system. They are used to temporarily stop, hold and release material. They allow efficiencies by regulating flow for maximum utilization of downstream sorting.**

Pulley: **Provides the transmission of torque from the drive and ensure that belts remain taut. A pulley is one of the main elements.**

3. Describe the basic function of robotics as it relates to the operation of the distribution center.

**Palletizing robots load cartons or other packaged items onto a pallet in a defined pattern. Depalletizing robots perform the same operation in reverse order. Autonomous Guided Vehicles (AGV) are unmanned mobile robots that are used to move product around a warehouse. Integrated Warehouse Management Systems can automatically move the AGV on pick routes to allow a human operator to pick an order that is loaded on the AGV.**

4. Describe each of the predictive maintenance techniques.

Infrared thermography: **Utilizes radiation emitted in the infrared light spectrum to image and measure thermal problems that are normally undetectable to the human eye. It detects overloaded hot circuits, low integrity or high resistance connections and overrated wiring.**

Vibration analysis: **Sensors monitor and transmit records of wave forms and measure degrees of equipment vibration. Software interprets excessive or irregular vibration that might indicate developing problems.**

Oil analysis: **Oil samples from equipment are sent to a lab to measure contaminants in the lubrication to assess mechanical wear.**

5. Describe each of the following programming methods.

Pendent programming: **Manual control of a robotic device using a control pendent.**

Computer Controlled Programming: **Automated control of a robotic device with commands issued from the computer.**

# Automated Distribution Center Questions

Student Name \_\_\_\_\_

Date\_\_\_\_\_

This is the worksheet that is to be used during a Distribution Center tour.

\_\_\_\_\_1. How many receiving docks are located in the facility?

\_\_\_\_\_2. How many receiving lines or areas exist to input into the sorting or storage areas?

3. What type of distribution automation systems are used?

\_\_\_\_\_  
\_\_\_\_\_

4. What is the primary means of moving product from the receiving docks to the automated system?

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_5. What is the total piece count that flows into the distribution center each day?

\_\_\_\_\_6. What percentage of product is put into storage and how long will they remain there?

7. What type of picking processes are done within the distribution center?

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_8. How many total employees work in the facility and what are the hours of operation?

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Automated Distribution Center Solutions

Student Name \_\_\_\_\_

Date\_\_\_\_\_

This is the worksheet that is to be used during a Distribution Center tour.

\_\_\_\_\_1. How many receiving docks are located in the facility?

\_\_\_\_\_2. How many receiving lines or areas exist to input into the sorting or storage areas?

3. What type of distribution automation systems are used?

**Answers can include belts, rollers, sorting arms.**

4. What is the primary means of moving product from the receiving docks to the automated system?

**Answers can include forklift, pallet jacks, conveyors.**

\_\_\_\_\_5. What is the total piece count that flows into the distribution center each day?

\_\_\_\_\_6. What percentage of product is put into storage and how long will they remain there?

7. What type of picking processes are done within the distribution center?

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_8. How many total employees work in the facility and what are the hours of operation?

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_



# Automated Warehouse Visitation Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

Company Title\_\_\_\_\_

Types of materials  
handled\_\_\_\_\_

Square footage of facility\_\_\_\_\_

Total product stored\_\_\_\_\_

Number of employees/shifts\_\_\_\_\_

Number of maintenance technicians\_\_\_\_\_

Number of Items  
handled\_\_\_\_\_

Number of receiving bays/shipping bays\_\_\_\_\_

Total length of conveyor system\_\_\_\_\_

List the types of conveyor lines\_\_\_\_\_

Types of receiving/shipping equipment used\_\_\_\_\_

Types of storage  
systems used\_\_\_\_\_

Types of picking  
that is used\_\_\_\_\_

How is maintenance  
scheduled? \_\_\_\_\_

Are outside contractors used for maintenance? \_\_\_\_\_

What type of training do maintenance technicians have and what do  
you provide?  
\_\_\_\_\_  
\_\_\_\_\_



What are the important skills needed by a maintenance technician?

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Tools and Construction Materials Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. List the types of screwdrivers and describe their characteristics.

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2. Describe the operation of the Micrometer.

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3. Complete the following conversions.

28C = \_\_\_\_\_ F

1" = \_\_\_\_\_ MM

1 Gal= \_\_\_\_\_ quarts

100 PSI =\_\_\_\_\_ Bar

4. Describe the increase or decrease of speed and torque as is designed in gear sets.

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5. Describe the applications for each of the following belt designs.

Flat belt

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V-belt

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Cogged belt

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6. Describe the operating characteristics for the following gear sets.

Straight gears

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Bevel gears

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Worm gears

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7. Describe the steps that you would use to perform a failure analysis within a Distribution Center.

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Tools and Construction Materials Solutions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. List the types of screwdrivers and describe their characteristics.

**Slotted: single blade; Phillips: 4 point star with a round center;  
Square: 4 sided post;**

**Hex: 6 sided post; Torx: 6 pointed star; Pozidrive: 4 points star  
with a 4 point center.**

2. Describe the operation of the Micrometer.

**Turn the thimble until the measuring points are snug on the  
device and read the barrel increments to determine the size. The  
numbered lines represent 100 thousandths (one tenth 0.1), the  
increments between represent 25 thousandths (0.025) and the  
individual numbers on the thimble represent one thousandth  
(0.001).**

3. Complete the following conversions.

28C = **82.4** F

1" = **25.4** MM

1 Gal= **4** quarts

100 PSI =**6.9** Bar

4. Describe the increase or decrease of speed and torque as is  
designed in gear sets.

**The twisting force that is exerted on a shaft with a machine is  
torque. Torque can be increased by going from a smaller drive  
device to a larger driven device. The multiplication of torque  
results in more power, but less speed.**

5. Describe the applications for each of the following belt designs.

Flat belt: **The belt or tension system changes direction to drive  
multiple loads from both sides of the belt.**

V-belt: **The belt has a large surface area to contact the pulley and  
is self-centering. Larger power systems use multiple groove  
pulleys and multiple belt to transfer torque and speed.**

Cogged belt: **The belt is used to transfer high torque energy. It allows no slippage so that the transfer of energy is more controlled.**

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

6. Describe the operating characteristics for the following gear sets.

Straight gears: **These have gear teeth that are parallel to the direction of rotation. There are no side loads placed on the gears and they transfer torque in the same plane to a driver gear. They produce substantial noise during operation.**

Bevel gears: **These are cone shaped to transfer torque and speed between shafts that are not in the same plane. They produce heavy side thrusts on the gears, so they must be used in a strong, well supported housing. They can be manufactured with a spiral gear tooth to produce a quiet operation.**

Worm gears: **These are used for slow operation with high torque, speed reduction and a change in direction. The worm gear is on a shaft which drives a wheel gear in the perpendicular direction.**

7. Describe the steps that you would use to perform a failure analysis within a Distribution Center.

**Use computers, visual inspection or infra-red heat sensors to locate failures or hot spots in motors can controls so as to locate the “root cause” and make repairs so that problem doesn’t repeat**

# Electrical Concepts & Meter Use Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. Describe the characteristics of the following:

Voltage\_\_\_\_\_

\_\_\_\_\_

Amperage\_\_\_\_\_

\_\_\_\_\_

Resistance\_\_\_\_\_

\_\_\_\_\_

Alternating Current

\_\_\_\_\_

\_\_\_\_\_

Direct

Current\_\_\_\_\_

\_\_\_\_\_

2. List the circuit laws as they apply to the following circuits.

## Series

Voltage

\_\_\_\_\_

Amperage

\_\_\_\_\_

Resistance

\_\_\_\_\_

## Parallel

Voltage

\_\_\_\_\_

Amperage

\_\_\_\_\_

Resistance

\_\_\_\_\_

3. Describe each of the following circuit faults.

Open

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Short to voltage

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Short to ground

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High resistance

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4. Describe the operation of each of the following semi-conductors.

Diode\_\_\_\_\_

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Transistor

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_



# Electrical Concepts & Meter Use Solutions

1. Describe the characteristics of the following:

Voltage: **It is the electrical difference between two points of a circuit or the difference in electrical potential energy between two points.**

Amperage: **It is the movement of electrons through a circuit expressed and measured in amperes. Amperes are the component that is based on the movement of electrons through a conductor.**

Resistance: **The opposition to the movement of electrons in an electric current through a conductor.**

**Conductance is the ease by which an electric current passes electrons.**

Alternating Current: **It is voltage or current which changes polarity or direction over a given time. It is the most common form of electrical energy used in industry.**

Direct Current: **DC voltage or current maintains constant polarity or direction. It is used to power sensors, lights and communication networks at a low voltage.**

2. List the circuit laws as they apply to the following circuits.

## Series

Voltage: **Voltage is the sum of the drops across each component in the circuit.**

Amperage: **It is the same at any point of the circuit.**

Resistance: **Total resistance is the sum of the individual resistances.**

## Parallel

Voltage: **Voltage is the same on each branch of the circuit.**

Amperage: **Total current is the sum of the individual branch currents.**

Resistance: **Total resistance must be less than the value of the smallest resistor.**

3. Describe each of the following circuit faults.

Open: **It is an incomplete pathway within the circuit. In a series circuit, it will affect the entire circuit. In a parallel circuit, it will only affect the faulted pathway.**

Short to voltage: **When wires from one circuit are connected to power from another circuit: This failure involved the power from another circuit.**

Short to ground: **When the current flow bypasses a load and goes directly to ground prior to the component.**

High resistance: **When the wiring or components are partially faulted, allowing less current to flow so less work is done.**

4. Describe the operation of each of the following semi-conductors.

Diode: **A two wire semiconductor that allows voltage to flow in one direction and block current flow in the other direction.**

Transistor: **A three wire semiconductor that allows voltage to flow through an electronic circuit when a signal has been received at the base.**

# Hydraulics & Pneumatics Questions

Student Name\_\_\_\_\_

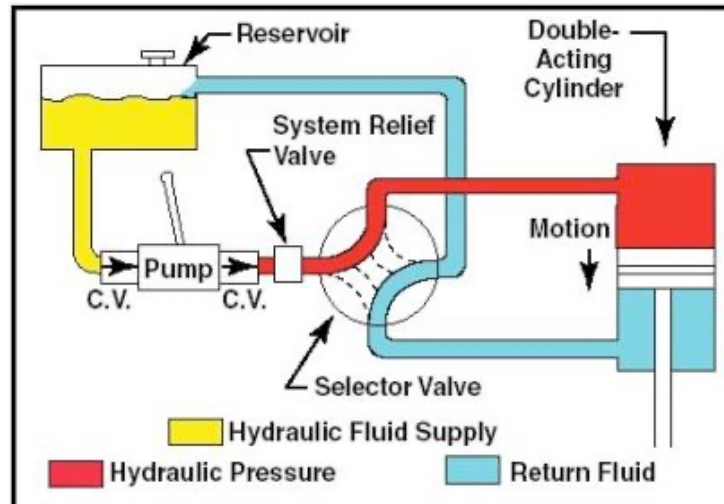
Date\_\_\_\_\_

1. Describe the power and movement transfer during the operation of the following diagram.

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2. Describe the five basic components of a hydraulic system.

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3. Describe the following types of positive displacement compressors.

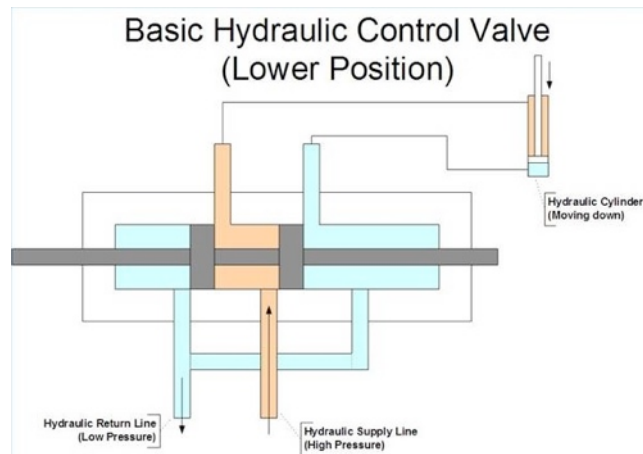
Piston compressor\_\_\_\_\_

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Rotary screw compressor\_\_\_\_\_

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4. Describe the operation of the following control valves.



Pressure relief valve\_\_\_\_\_

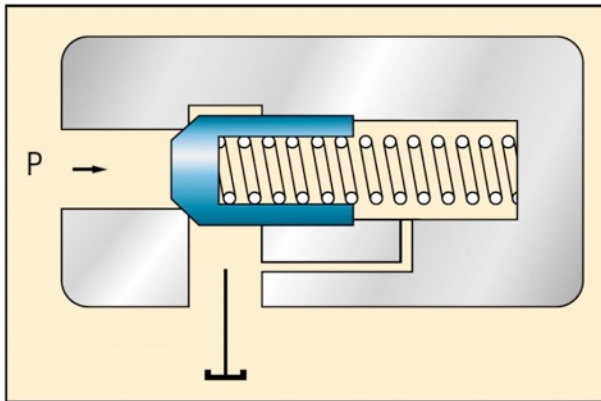
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Instructor Name\_\_\_\_\_

Date\_\_\_\_\_

Hydraulic pressure relief valve

Closed position



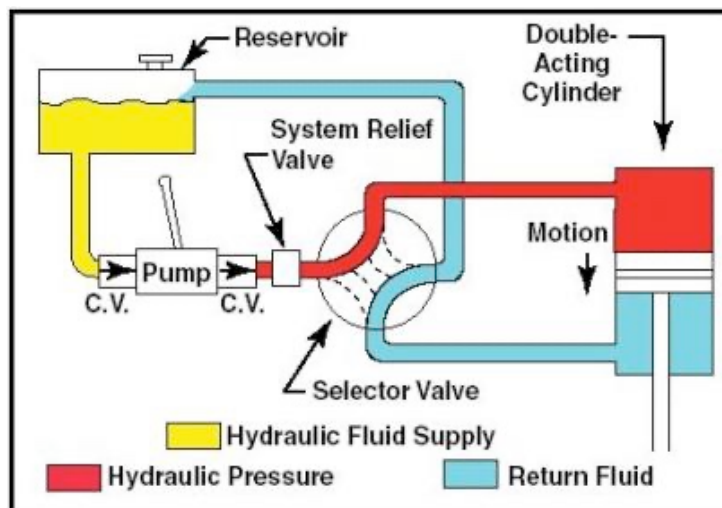
Control valve\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

# Hydraulics & Pneumatics Solutions

1. Describe the power and movement transfer during the operation of the following diagram.

**Yellow fluid in the reservoir is pumped through the system relief valve creating red pressurized fluid. This pressure depresses the double acting cylinder to perform some type of work. In addition, the downward action of the cylinder creates pressure on the blue fluid to refill the reservoir.**



2. Describe the five basic components of a hydraulic system.

**Reservoir: contains excess system fluid, removes impurities by settling**

**Pump: creates the pressure and volume required to transfer energy**

**Cylinder: receives power from pressurized hydraulic fluid**

**Fluid cooling/filtering systems: to address temperature increases and unwanted particles**

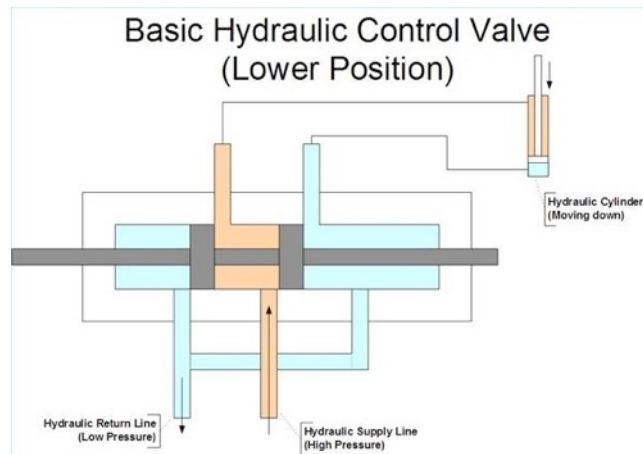
**Control systems: direct pressure to the correct side of the cylinders**

3. Describe the following types of positive displacement compressors.

**Piston compressor: Pistons are driven by a crankshaft to deliver gases at high pressure. The action of the piston generates a surging of the flow.**

**Rotary screw compressor: It uses a rotary type positive displacement mechanism. This produces a continuous flow, so there is very little pulsation.**

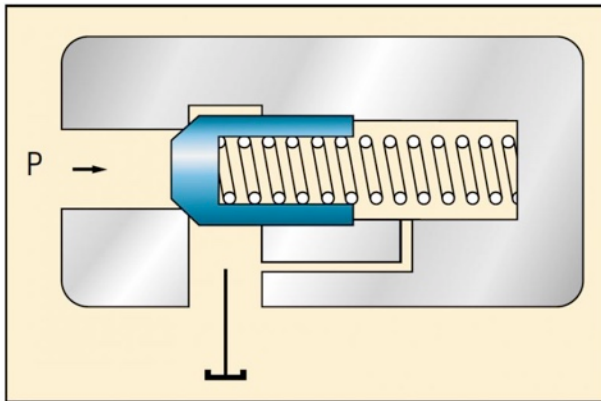
4. Describe the operation of the following control valves.



Pressure relief valve: **Pressurized fluid from the left is forced against the piston that is depressed to the right. Fluid exits from the bottom of the valve while a spring returns the piston to its original position.**

Hydraulic pressure relief valve

Closed position



Control valve: **Fluid is placed under pressure and enters the valve by the supply line. The high pressure fluid depresses the cylinder to perform work. The cylinder also provides enough energy to pump fluid to exit through the return line.**



# PLC Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. Draw a simple PLC circuit to include inputs, outputs and components.

2. Describe how the following tools are used in PLC programming.

Master controller

\_\_\_\_\_  
\_\_\_\_\_

EPROM

\_\_\_\_\_

Ladder logic

\_\_\_\_\_  
\_\_\_\_\_

Digital Volt Ohmmeter\_\_\_\_\_

\_\_\_\_\_

3. Identify the features of the following PLC tools.

Allen Bradley PLC 5

\_\_\_\_\_  
\_\_\_\_\_

SLC 500

\_\_\_\_\_  
\_\_\_\_\_

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_



# PLC Solutions

1. Draw a simple PLC circuit to include inputs, outputs and components.



2. Describe how the following tools are used in PLC programming.

Master controller: **It implements ladder logic and consists of a PLC rack consisting of a power supply and a chassis to interface communications between the cards and controller input and outputs for operation of the conveyor.**

EPROM: **A type of nonvolatile, programmable, read-only memory that is a component of the master controller, its main purpose is to retain the logic of the PLC program in case of power loss.**

Ladder logic: **An industry standard line drawing for representing relay logic control systems, it describes the programming of the PLC.**

Digital Volt Ohmmeter: **A tool for checking voltages on PLCs, a DVOM is critical for effective and accurate analysis for proper operations and troubleshooting.**

3. Identify the features of the following PLC tools.

Allen Bradley PLC 5: **It is the first and oldest PLC with programming by Rockwell software: RSLogix 5 Software with RSLinx communication software; it is compatible with Mitsubishi PLCs.**

SLC 500: **PLC is in one or more PLC racks consisting of a power supply, a PLC adapter converting Ethernet connections for communication from other PLCs and the master controller as well as input and output modules.**

# Sensor Questions

1. List the types of sensors that are used in each application.

Weight \_\_\_\_\_

Personal identification \_\_\_\_\_

Speed \_\_\_\_\_

Count \_\_\_\_\_

2. Describe the process of a sensor and label working together for barcode applications.

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3. Describe the advantages and disadvantages of bar code reading and Radio frequency identification.

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4. What are some of the concerns that need to be considered when mounting different types of sensors?

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Sensor Solutions

1. List the types of sensors (optical, Hall effect, RFID, piezoelectric) that are used in each application.

Weight **piezoelectric**

Personal identification **RFID**

Speed **optical, Hall effect**

Count **optical, Hall effect, RFID, piezoelectric**

2. Describe the process of a sensor and label working together for barcode applications.

**A scanner's light source illuminates a label's white and black lines that are read by the scanner's light sensor. The image is translated into digital signals that are sent to the scanner's output port for use throughout the control system. Hand held scanners provide portability to the process.**

3. Describe the advantages and disadvantages of bar code reading and Radio frequency identification.

**Barcode labels are inexpensive and can support labeling all items in a lot. RFID tags are less expensive and are challenged when labeling all items in a lot. Barcode technology requires a line of sight between the reader and the scanner. RFID does not require a line of sight, but is challenged by reading through liquids.**

4. What are some of the concerns that need to be considered when mounting different types of sensors?

**Optical scanners require a line of sight between the scanner and the object being scanned. Hall effect sensors work in response to magnetism and would be impacted by magnetic fields. Some RFID scanners have limited read zones of 3-6 inches and so would need to be mounted near the scanned object. Piezoelectric sensors measure weight and would be sensitive to vibrations near the mounting point.**

# HVAC Questions

Student Name \_\_\_\_\_

Date\_\_\_\_\_

1. List the major parts of an air distribution system.

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2. Describe each of the following heating systems.

Heated water system

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Fueled heating

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Electric heating

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3. Use the Temperature/Pressure chart for refrigerant to determine the ideal evaporator pressure for the refrigerant R134 for given -temperatures.

| Temperature (Fahrenheit) | R134 Pressure | R12 Pressure |
|--------------------------|---------------|--------------|
| 0                        |               |              |
| 25                       |               |              |
| 50                       |               |              |
| 75                       |               |              |
| 100                      |               |              |

4. Describe the operation of the thermostat.

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_



# HVAC Solutions

1. List the major parts of an air distribution system.

**Blower motors, fans, air handlers, heating & cooling element, filters**

2. Describe each of the following heating systems.

Heated water system: **Water is heated in a boiler or heated tank and is circulated throughout a facility to heat spaces. The system circulates heated water independently of the building's normal water supply.**

Fueled heating: **Natural gas or oil is used to heat air or water that is circulated throughout the space. Filters and lowers are used to direct and clean the air before it enters the controlled space.**

Electric heating: **Air is heated by blowing it across and electrically heated element. Electric resistance heating can be provided by baseboard heaters, space heaters, radiant heaters, furnaces, wall heaters or thermal storage systems.**

3. Use the Temperature/Pressure chart for refrigerant to determine the ideal evaporator pressure for the refrigerants R134 and R12 for given temperatures.

| Temperature (Fahrenheit) | R134 Pressure | R12 Pressure |
|--------------------------|---------------|--------------|
| 0                        | 6.5           | 9.2          |
| 25                       | 22.1          | 24.6         |
| 50                       | 45.4          | 46.7         |
| 75                       | 78.8          | 77.0         |
| 100                      | 124.0         | 117.2        |

4. Describe the operation of the thermostat.

**Thermostats control the HVAC system by controlling the correct pressures within the refrigeration system, air flow in the distribution system and air temperatures. A programmable thermostat adjusts the temperature according to a series of programmed settings that take effect at different times of the day.**

# Welding Processes Questions

Student Name \_\_\_\_\_

Date\_\_\_\_\_

1. Describe the basic concept of the welding process as used in fabrication.

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\_\_\_\_\_

\_\_\_\_\_

2. Describe each of the following welding processes.

Oxyacetylene welding and cutting

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Arc welding

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Wire feed welding

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. List the Personal Protection items that are commonly used during welding.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Welding Processes Solutions

1. Describe the basic concept of the welding process as used in fabrication.

**Welding joins metals by creating a bond from melted materials. A small area of the materials is melted where they contact, and a filler material is used to form a pool of molten material that when cooled becomes a strong joint to adhere the metals.**

2. Describe each of the following welding processes.

Oxyacetylene welding and cutting: **Oxygen is used to increase the flame temperature and allow localized melting of the material up to a temperature of 3500F. No electricity is necessary which introduces an aspect of portability.**

Arc welding: **Electrical power is used to create an electric arc between an electrode and the base material, which provide intense heat to melt the metals at the welding point. The process can be manual, semi-automatic or fully automated.**

Wire feed welding: **The gas metal arc welding process automatically feeds wire to the weld as filler at the same time it creates the arc to make heat. A hand feed filler rod can be used**

**to supplement the weld pool and provides better control over the weld.**

3. List the Personal Protection items that are commonly used during welding.

**Answers can include heavy level gloves, protective long sleeve jackets, goggles and welding helmets with dark UV-filtering face plates, translucent welding curtains, keeping combustible materials away from workplace.**



# Workplace Communications Questions

Student Name\_\_\_\_\_

Date\_\_\_\_\_

1. What are five components (items) of customer service?

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2. What are four kinds of written communication forms a SCT may be required to fill out or complete?

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3. What are some expectations for e-mails?

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4. What are the eleven effective listening strategies?

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5. What are the six most common customer expectations?

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Instructor Grade\_\_\_\_\_

Date\_\_\_\_\_

# Workplace Communications Solutions

1. What are five components (items) of customer service?

**Reliability, assurance, tangibles, empathy and responsiveness**

2. What are four kinds of written communication forms a SCT may be required to fill out or complete?

**Repair orders, work logs, equipment maintenance journals, and incident reports**

3. What are some expectations for e-mails?

**Be clear, organized, and professional**

4. What are the eleven effective listening strategies?

**Taking the time to listen, not doing most of the talking yourself, avoiding distractions, acting interested in what the other person says, asking questions, summarizing, being empathetic, not losing your temper, not interrupting, jotting down notes and reviewing them, using active listening techniques**

5. What are the six most common customer expectations?

**1) Friendliness**

**2) Empathy**

**3) Accuracy**

**4) Professionalism**

**5) Promptness**

**6) Honesty**

# Supplemental Exercise Worksheet Downloads

## Chapter 1:

[Career Awareness Questions](#)

## Chapter 2:

[Industry Certification Questions](#)

## Chapter 3:

[Supply Chain Principles Questions](#)

## Chapter 4:

[Safety Questions](#)

[Facility Safety Evaluation](#)

## Chapter 5:

[Mobility & Robotics Equipment Questions](#)

[Automated Distribution Center Questions](#)

[Automated Warehouse Visitation Questions](#)

## Chapter 6:

[Tools and Construction Materials Questions](#)

## Chapter 7:

[Electrical Concepts & Meter Use Questions](#)

## Chapter 8:

[Hydraulics & Pneumatics Questions](#)

**Chapter 9:**

[PLC Questions](#)

**Chapter 10:**

[Sensor Questions](#)

**Chapter 11:**

[HVAC Questions](#)

**Chapter 12:**

[Welding Processes Questions](#)

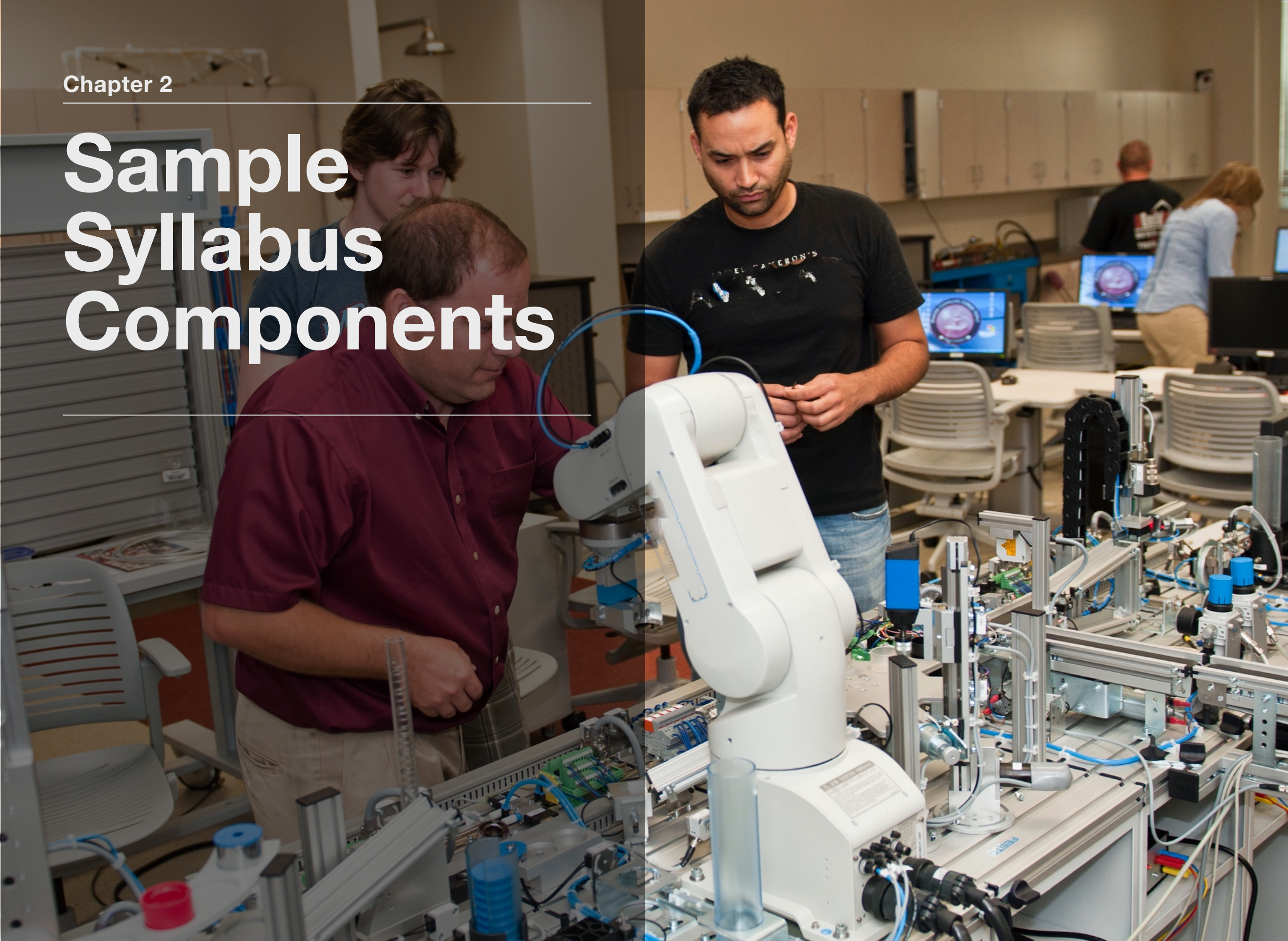
**Chapter 13:**

[Workplace Communications Questions](#)



## Chapter 2

# Sample Syllabus Components





## Examples of Student Learning Outcomes

*Learning outcomes, also known as objectives, may vary according to institutional requirements and facilities. The following are examples and are representative of the content of the e-book.*

*For an additional example, visit the link below:*

<http://www.supplychainautomation.com/course-outlines.html>

**Upon successful completion of the course, students should be able to:**

- Explain safety procedures related to working in a distribution center;
- Describe the functions performed by PLC's, scanners and label makers;
- Demonstrate the use of sensors and tracking devices in order to maintain maximum productivity;
- Describe correct scales, symbols and meanings used in diagrams and schematics;
- Demonstrate an understanding of material handling equipment;
- Employ an understanding of the robots and machinery used in warehouses and their maintenance;

- Apply an understanding of the basics of electricity and troubleshooting in warehouses;
- Utilize a basic understanding of welding and its application in warehouses;
- Demonstrate knowledge of basic PLC to control HVAC system;
- Apply an understanding and technical skill set to support HVAC control system projects;
- Utilize a basic understanding of Hydraulics/Pneumatics
- Practice effective communication methods with co-workers, customers and management.

## Sample Weekly Course Outline with Readings

*Note: Numbers after optional readings refer to case study number.*

### Week 1 Introduction to Course; Ch. 1, Career Awareness

*Optional Reading Case Study: "Worrying About Co-Workers' Non-Compliance with Company Policy" (1)*

### Week 2 Ch.1; Ch. 2, Industry Certification

### Week 3 Ch. 3, Supply Chain Principles

*Optional Reading Case Studies: "Beyond Borders: Cold Supply Storage and Shipping Saves Lives in Laos" (2);*



“What Would You Do? New Inventory Control System Thwarts Thieves” (5);

“Leading the Way: Cardinal Health Offers Customized Distribution for Healthcare Providers” (7);

“Leading the Way: Sysco Utilizes Warehouse Technology to Keep Customers Safe” (9)

#### **Week 4 Ch. 4, Safety**

*Optional Reading Case Studies:* “What Would You Do? Covering Up After a Hazardous Material Container Mishap” (14);

“What Would You Do? When Inadequate Training Creates an Accident” (20);

“What to Do When a Medical Incident Could Mean Losing a Job” (21)

#### **Week 5 Ch. 5, Material Handling**

*Optional Reading Case Study:* “Thinking Green: Beyond Borders: Nike Utilizes Long Loop Sorter Technology to Better Serve Customers in EMEA Region” (4)

#### **Week 6 Ch. 5, Material Handling (continued)**

*Optional Reading Case Studies:* “Renovating a Warehouse with the Planet in Mind” (16);

“What Would You Do? Coming Truthful with a Client or Covering Up for a Loyal Employee?” (19);

“Turning a Corner with Technology: Case Picking System More Efficiently Packs Pallets of Beer Cases” (15);

#### **Week 7 Ch. 6, Fundamentals of Mechanics**

*Optional Reading Case Studies:* “Beyond Borders: Conveyor System is Center of Coca-Cola Romania’s Mega Warehouse” (3);

“Think Green: Safe Lubricant Disposal Saves Time, Money, Environment” (6);

“Leading the Way: Sysco Utilizes Warehouse Technology to Keep Customers Safe” (9);

“Turning the Corner with Technology: Global Chocolate Producer Finds Sweet Satisfaction with New Warehouse Automation (11)

“Thinking Green: Renovating a Warehouse with the Planet in Mind” (16)

#### **Week 8 Ch. 7, Electrical**

*Optional Reading Case Studies:* “Thinking Green: Electronic Parts Distributor Models Energy Efficiency” (13);

“Think Green: Wal-Mart Designs Canadian Distribution Center to Save Costs, Increase Sustainability” (12)

## **Week 9 Mid-Term Examination, TBA**

### **Week 10 Ch. 8, Hydraulics/Pneumatics**

### **Week 11 Ch. 9, Programmable Logic Controller Basics**

*Optional Reading Case Study:* “Turning a Corner with Technology: Diapers.Com Leaves the Roaming to Robots” (10);

### **Week 12 Ch. 10 Scanning and Optical Sensors**

*Optional Reading Case Studies:* “Turning a Corner with Technology: Sierra Marine Charts New Course with CipherLab Scanners” (8);

“Leading the Way: Trident Seafoods “(18);

“Beyond Borders: Warehouse Automation Essential When Working with Vendors from the Far East “ (17);

“What Would You Do? New Inventory Control System Thwarts Thieves” (5)

### **Week 13 Ch. 11, Heating, Ventilation, and Air Conditioning**

### **Week 14 Ch. 12, Welding**

### **Week 15 Ch. 13, Work Place Communication**

*Optional Reading Case Study:* “What Would You Do? Coming Truthful with a Client or Covering Up for a Loyal Employee?” (19)

## **Week 16 Final Examination**

### **Sample Outline of Topics**

A. Introduction to the Automated Warehouse

B. Career Awareness, Industry Certifications, Supply Chain Principles

C. Certification

1. Certified Production Technician (CPT)
2. Certified Logistics Technician (CLS)

D. Safety Function and Strategy

1. Planning, Accountability and Reporting
2. Codes and Standards
3. Emergency Shut Off Devices
4. Personal Protection Equipment
5. Hazardous Materials
6. Technician Safety
7. Fire Safety and Prevention
8. First Aid

E. Materials Handling Equipment

1. Material Handling Equipment
2. Industrial Trucks
3. Engineering Systems
4. Automate Storage and Retrieval Systems (AS/RS)

5. Industrial Robots
6. Autonomous Guided Vehicles (AGVs)
7. Maintenance Processes
8. Prioritization
9. Record Keeping
10. Activities

## F. Fundamentals of Mechanics

1. Overview
2. Measurement
3. Tools and Application
4. Physical Properties
5. Structures
6. Lifting and Piping
7. Mechanical Drives
8. Fasteners

## G. Electrical Principles

1. Overview
2. Electrical Safety
3. Electrical Principles
4. Circuits and Diagrams
5. Prints
6. Power Distribution
7. Test Equipment
8. Solid State Semiconductor Devices
9. Controls

## H. Hydraulics/Pneumatics

1. Hydraulics Overview
2. Pneumatics Overview

## I. Programmable Logic Controller (PLC)

1. Programmable Logic Controller (PLC) Basics

## J. Scanning and Optical Sensors

1. Overview
2. Optical Sensors (Light)
3. Hall Effect Sensors (Magnetism)
4. RFID (Radio Frequency Identification)
5. Piezoelectric
6. Trouble Shooting

## K. Heating, Ventilation and Air Conditioning (HVAC)

1. Overview
2. Physical Properties
3. Air Distribution
4. Heating
5. Refrigeration Cycle
6. Controls
7. Automation Systems
8. Energy Management
9. Maintenance

## L. Welding

1. Overview
2. Gas Welding and Cutting
3. Arc Welding
4. Wire Feed Welding
5. Welding Safety and Precautions

#### M. Work Place Communications

1. Work Place Communications
2. Activities
3. Questions to Consider

#### Sample Written Assignments

The topics below represent a few possibilities for written assignments of varying lengths. Short one or two paragraph answers can be based upon the e-textbook chapter content or the Vignettes/Case Studies.

Longer (research/synthesis) papers may draw upon a combination of optional sources. Papers using outside sources may be based upon the White Papers found on the National Center for Supply Chain Automation site:

<http://www.supplychainautomation.com>.

Research/Synthesis Notes: These assignments may also include other already available sources, including materials from the e-textbook and the case studies/vignettes if the course requirements include a longer paper for 3-7+ pages. According to

length requirements, student may research topics for appropriate articles on their own.

All papers using sources will have documentation, whether it is the instructor's informal or formal documentation of sources used. Formal documentation of sources should follow MLA or APA guidelines, including Works Cited or Reference pages as required by the instructor. Students can find helpful guides to the use of quotation marks and other documentation on-line such as on Purdue University On-Line Writing Lab site (OWL) at

<https://owl.english.purdue.edu/owl/>.

Note: Numbers following Vignettes and Case studies suggested below denote the number of the source in that section.

#### Writing Topics Using Sources:

**Sample Topic:** Skills needed for being a warehouse technician

*E-textbook Optional Source(s):* Chapter 1, Chapter 2

*Optional source:* National Center for Supply Chain Automation White Paper: "Foundational Skills of the Supply Chain Technician" Michael S. Friesen, November 2012

<http://www.supplychainautomation.com/foundational-skills.html>

**Sample Topic:** Employment outlook for Automated Warehouse employee vs. other entry level position for community college students

*E-textbook Optional Source(s):* Chapter 1, Chapter 2

*Optional Source(s):* National Center for Supply Chain Automation report: “Summary Report: Supply Chain Industries and Occupation in the U.S. Spring 2016” <http://www.supplychainautomation.com/national.html>

**Sample Topic:** Advantage of automated warehouse systems

*E-textbook Optional Source(s):* Chapter 3, Chapter 7

*Optional source:* National Center for Supply Chain Automation White Paper: “Factors Driving the Adoption of Automation in the 21st Century Warehouse,” Steve Harrington, October 2013

<http://www.supplychainautomation.com/adoption-of-automation.html>

*Vignettes/Case Studies Optional Source(s):*

“Think Green: Wal-Mart Designs Canadian Distribution Center to Save Costs, Increase Sustainability” (2)

“Turning a Corner with Technology: Sierra Marine Charts New Course with CipherLab Scanners” (8)

**Sample Topic:** Examples and select components of Automated Supply Chain Technologies

*E-textbook Optional Source(s):* Chapter 3, Chapter 6, Chapter 10

*Optional source:* National Center for Supply Chain Automation White Paper: “Three Facilities That Practice Leading Edge Supply Chain Technologies”, David G. Meyer, 2012

<http://www.supplychainautomation.com/supply-chain-technologies.htm>

*Vignettes/Case Studies Optional Source(s):*

“Beyond Borders: Conveyor System is Center of Coca-Cola Romania’s Mega Warehouse” (3)

“Turning a Corner with Technology: Diapers.Com Leaves the Roaming to Robots” (8)



## Chapter 3

# Select Activities for Lab Periods





# Supply Chain Technician Career Awareness Lesson Plan

[Print the pre & post survey here.](#)

Take a moment and ask yourself the following questions:

1. How did the shoes that you are wearing get from the shoe manufacturer to your feet?
2. How do you order something online right now knowing that it will get delivered to your home tomorrow?
3. How many different types of soda are available for purchase?

Take a few minutes and watch the material handling as a career video:

## **Movie 3.1** Material Handling as a Career



Tap to view a video

Now that you know there is a need for supply chain technicians, let's look the different processes that occur in an automated warehouse.

[Learn about the different areas of the automated distribution center.](#)

- Click on the icons in the left column that represent the different processes used in an automated warehouse (i.e. Receiving, Put away/Replenishment, Order fulfillment, etc.)

Now that you have a better idea of the technology used in the automated distribution center, who is going to keep this automated equipment running?

Click on this video to learn more about who maintains this technology.

### **Movie 3.2** What is a Supply Chain Technician?



Tap to view a video

To help you understand why so much automation is being added to warehouses, think for a moment and discuss what areas are driving the need for this technology? Here are 3 examples.

1. E--commerce

2. Accuracy & efficiency
3. Massive amount of available products

### [Learn More:](#)

As a student, what do you need to do to enter into this exciting field?

- What do you need to know?
- What do you need to do?
- What skills do you need to have?
- How much money are you going to make?

### [Take a look at this occupational profile.](#)

What types of classes will you need to take to prepare yourself for this career?

### [Here is a sample program of study](#)

Recap closing evaluation questions with students as they complete the post survey

Note: please collect the completed pre & post survey document and submit them to the National Center for Supply Chain Technology Education.

# Career Awareness Presentation Outline and Support

This is an overview of the power point presentation that is presently posted on the website and can be used to support the presentation.

## 1. Career awareness overview

- a. This slide should be shown prior to the start of the presentation
- b. Once the presentation is started describe the purpose of the presentation and the background of its development.
  - i. Include industry and workforce cooperation, opportunities and information*

## 2. Pre-survey

- a. Describe why we are doing the pre-survey
  - i. Accountability and data collection*

## 3. Answers to thought questions for participants

- a. Shoe question

- i. 98% of all shoes worn in the US are imported. How do they get here? Truck, ship, truck, distribution center, truck, store, purchaser*

## b. Online ordering

- i. 6-8% of all purchases are made on-line but growing 10-15% a year. Takes away from in-store sales and profitability.*
- ii. Processes - Products must be on-hand, picked, shipped, transported, delivered (in-store or home)*

## c. Soda availability

- i. Over 100 types of sodas are for sale in most major grocery stores*
- ii. Pepsi produces over 3,400 different products.*

## 4. What are Material Handling, Logistics and Distribution centers?

- a. Describe the terms and explain that they are all part of manufacturing, and product delivery.

- i. *Lead in to the 4 minute video*

### **Movie 3.3** Material Handling as a Career



Tap to view a video

### **5. What happens in an automated warehouse? (Show video)**

- a. Describe each area of operation and clarify any questions.
  - i. *Receiving*
  - ii. *Storage*
  - iii. *Picking*
  - iv. *Value added support*

- v. *Shipping*

### **6. Who is going to keep all this equipment running? You Are!**

- a. Talented people with diverse skills and training.
- b. Must have specific training and experience.

### **7. What is a Supply Chain Technician?**

- a. Track to get there
- b. Entry level technicians or advancement of existing employees
- c. Lead in to the video

### **Movie 3.4** What is a Supply Chain Technician?



Tap to view a video

### **8. What do you need to do to enter this career?**



- a. What do you need to know?
- b. What do you need to do?
- c. What skills you need?

**9. How much money are you going to make? Lists of what they need to know.**

- a. Read each list and elaborate as time permits

**10. Specializations and income**

- a. Larger facilities have more specialization, smaller have more general technicians. These technicians and their training also apply to the general area of manufacturing for more opportunities.
- b. Review each area as presented and describe needs and incomes
  - i. *Electronics technicians works with networks, PLCs and electrical supply*
  - ii. *Electro mechanical technicians work on sensors, motors and driven devices*
  - iii. *Industrial technicians work on mechanical devices such as conveyors, lift devices, repair*

**11. Technician overview slide**

- a. Read the definition
- b. Review each area as they relate to specializations

**12. What drives the need?**

- a. E-commerce
  - i. *Instant response, quick delivery of the product is expected*
  - ii. *Growing in volume*
- b. Accuracy and efficiency
  - i. *Accuracy is a given with today's controls*
  - ii. *Cost savings is expected*
- c. Massive amount of products and choices
  - i. *Internet information and volume*
  - ii. *Stores with huge volume but not stored on hand and in store*

**13. Courses required**

- a. Describe the necessity to get training, refer to the technicians in the video that obtained training after working at the company

- b. Review college curriculum
- c. Review certificate and degree programs (certificates being 24 to 36 units and degrees being a minimum of 60 to 64 units with general education included)

**14. Questions and comments from the participants.**

- a. Answer the questions but expand your answers to create interest.

**15. Post Survey**

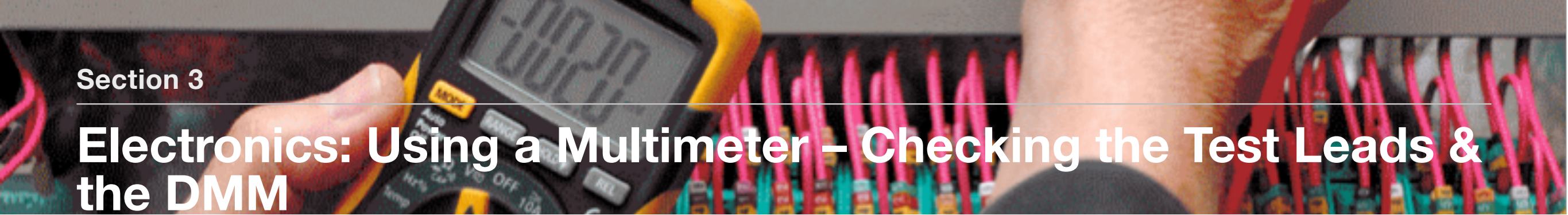
- a. Describe why we do the exit survey for collection of input and data.

**16. Visit the [National Center for Supply Chain Automation website](#) if available and time permits and demonstrate the browsing areas.**

- a. The online simulation would be a good demonstration
- b. Thank everyone who allowed you to do the presentation and thank the participants

**Please see the Supplemental Resources section at the end of this chapter to download the presentation.**





## Section 3

# Electronics: Using a Multimeter – Checking the Test Leads & the DMM

**Introduction:** The DMM (Digital Multimeter) is an important piece of equipment for troubleshooting equipment malfunctions and checking operational status of machines. To get accurate measurements, the DMM needs to be in good operating condition before use,

**Objective:** Check the DMM (Digital Multimeter) to ensure that it is working correctly before using it.

### Equipment:

- DMM (Digital Multimeter)
- 2) connecting test leads (1 red and 1 black)

### Procedures: Checking the Test Leads

A frequent cause of error in a multimeter measurement is the condition of the test leads.

To check the test leads first visually inspect them.

- Is there any exposed or frayed insulation on the test leads?

- If the answer is yes, replace the test lead(s).
- Can test alligator clips on the test leads firmly grip any wire that you clip to it?
- If the answer is no, replace the test lead(s).

**The DMM that you have may be labelled differently. If you have any questions, please ask your instructor.**

Turn on the DMM.

Check whether the battery condition indicator is showing in the meter's display.

If it is visible, the battery in the meter must be replaced.

Set the selector switch to measure resistance.

- If you have a DMM that has a manually selected measuring ranges, set it to the lowest resistance range, for example 200 ohms. Refer to Figure 1.

**Figure 1:** Setting the DMM to measure test lead resistance



- If you have a DMM that has auto ranging, set the selector switch on the DMM to the  $\Omega$  position. Refer to Fig. 2.

**Figure 2:** Auto Ranging DMM



- Connect the meter test leads to the proper jacks on the DMM as shown in Fig 3.
  - The black test lead should be connected to the COM or ground jack.
  - The red test lead should be connected to the V/ $\Omega$  jack.

**Figure 3:** Test lead jacks



**Data:**

What is shown on the DMM's display? Write your answer below.

DMM display: \_\_\_\_\_

Clip the other end of both test leads together.

What is shown on the display? Write your answer below.

DMM display: \_\_\_\_\_

Did anything change in the display?

\_\_\_\_\_

**Analysis:**

If the test leads are good, the display will show a resistance value of zero ohms or a value very close to zero.

If the resistance value does not change, change one or both of the test leads and repeat the test.

## Section 4

# Electronics: Using a Multimeter to Measure Current

**Introduction:** To maintain or troubleshoot machines, one must measure the electric systems' properties. The tool used to do some of this work is the DMM (Digital Multimeter). To check performance of a circuit, one must accurately find and read values of current in a circuit.

**Objective:** Learn to use a DMM to measure current

### Equipment:

Variable DC power supply

1 kOhm, ½ watt resistor

DMM (Digital Multimeter)

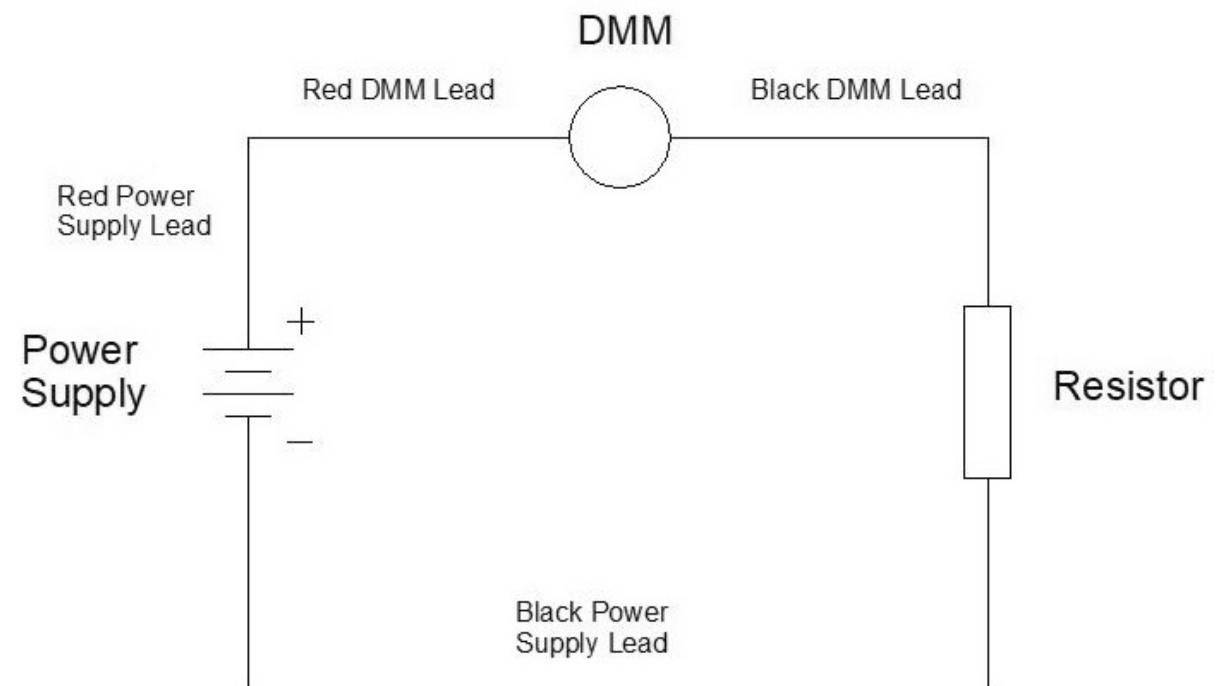
Breadboard

(4) connecting leads (2 red and 2 black)

### Procedures:

In order to measure the magnitude of electrical current in a circuit, the DMM must be **directly in the path of the current flow**. Refer to the schematic diagram below.

**Figure 1:** Connecting a DMM to measure current

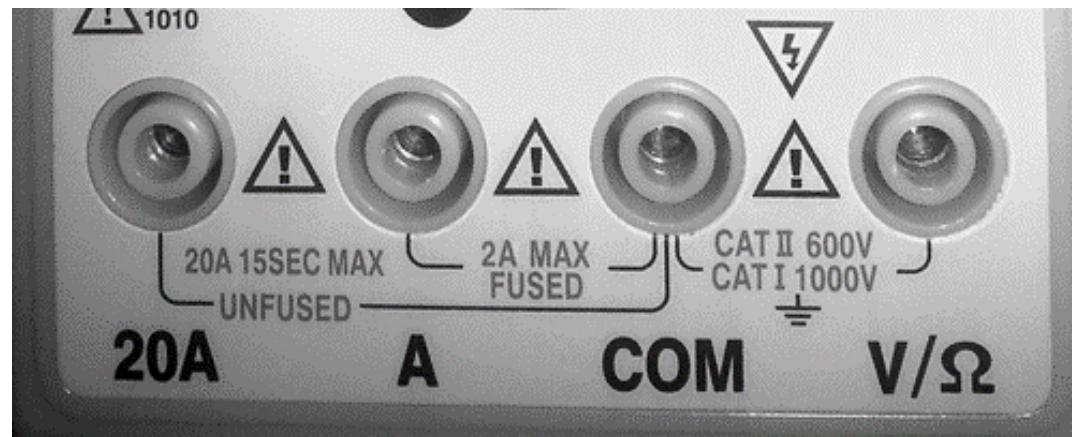


For the following steps, please note that if your multimeter is labelled differently, please ask your instructor for help.



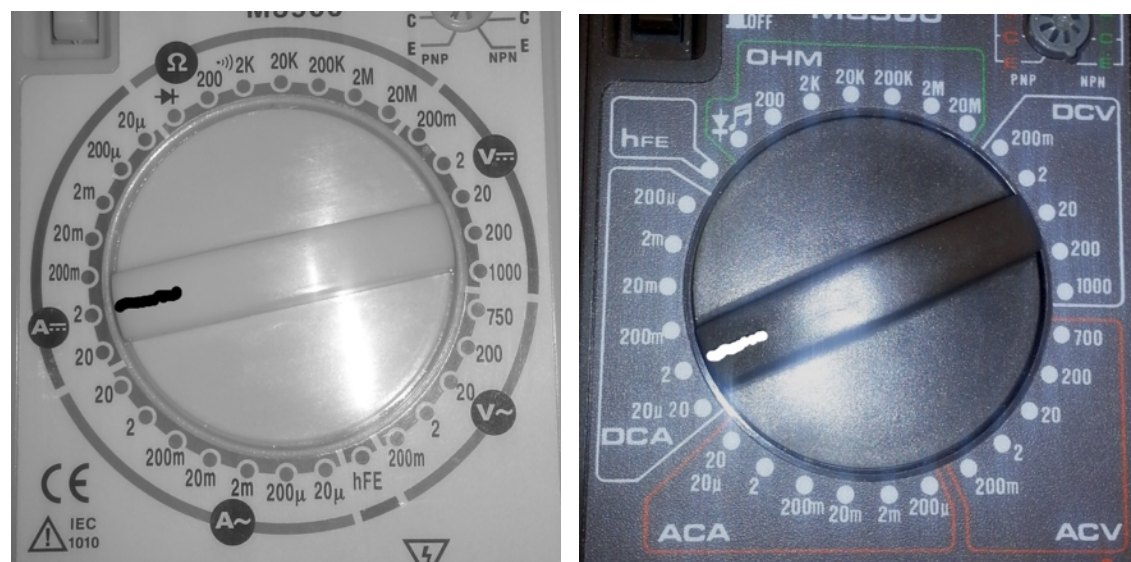
On the DMM, take out the **red** test lead and place its plug in the jack labelled as **A**.

**Figure 2:** DMM test lead jacks



Set the range selector switch on the DMM to the second highest DC current (e.g. DCA) measurement range (e.g. 2A).

**Figure 3:** DMM range selector switch



Connect a **red** test lead to the **red** or **(+)** terminal of the power supply.

Connect a **black** test lead to **black** or **(-)** terminal of the power supply.

Connect the **red** test lead on the DMM to the **red** test lead on the DC power supply.

Connect the **black** test lead on the DMM to one of the resistor leads.

Connect the **black** test lead from the DC power supply to the other resistor lead.

Turn on the DC power supply and set it for an output of **5 volts**. Record the voltage output of the power supply.

Output voltage: \_\_\_\_\_

Record the current measurement range, the DMM current reading, and the units of measurement (**μA**, **mA**, or **A**) which are shown on the test meter's display.

Progressively turn the range selector switch to a lower current measuring range. For each range, record the measurement range, the DMM reading, and the units of measurement.

Table 1

| DMM Current Range | DMM Current Displayed | Units |
|-------------------|-----------------------|-------|
| _____             | _____                 | _____ |
| _____             | _____                 | _____ |
| _____             | _____                 | _____ |
| _____             | _____                 | _____ |
| _____             | _____                 | _____ |
| _____             | _____                 | _____ |

Turn off the power supply.

**Analysis:**

1. What happened to the displayed values as you lowered the current range on the multimeter's selector switch?
2. What appeared in the display when you tried to measure the current at a range lower than the value of the measured current?
3. When measuring unknown current, why is it a good idea to initially measure that current at the highest range of the meter?

4. Using Ohm's Law, calculate the current going through the resistor given a voltage of 5-volts and the labelled resistance value of 1,000 ohms (1 k $\Omega$ ).
5. Explain why there is a difference between the measured and calculated values of the current going through the resistor?



## Section 5

# Electronics: Using a Multimeter to Measure Voltage

**Introduction:** To maintain or troubleshoot machines, one must measure the electric systems' properties. The tool used to do some of this work is the DMM (Digital Multimeter). To check performance of a circuit, one must accurately find and read values of voltage in a circuit.

**Objective:** Learn how to use a DMM (digital multimeter) to measure voltage

### **Equipment:**

Variable DC power supply

DMM (Digital Multimeter)

(2) test leads (1 red and 1 black)

### **Procedures:**

If you have not done so already, check your DMM and test leads. Refer to Lab #1.

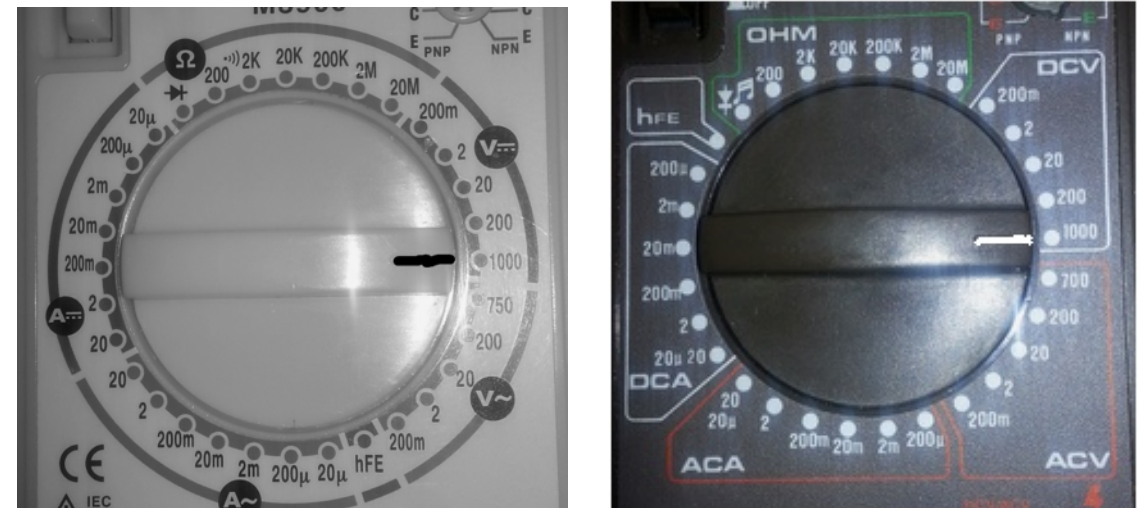
**The DMM that you have may be labelled differently. If you have any questions, please ask your instructor.**

Turn on the DMM.

Set the selector switch to measure DC voltages.

Set it to the highest voltage range, for example 1000 volts. Refer to the example shown in Fig. 1.

**Figure 1:** Range selector switches



Connect the meter leads to the proper jacks on the DMM as shown in Fig. 2.

The **black** test lead should be connected to the **COM** or ground jack.

The **red** test lead should be connected to the **V/ $\Omega$**  jack.

**Figure 2:** Test lead jacks



The power supply that you have may be different. If you have any questions, please ask your instructor.

Turn on the power supply and adjust it to supply 2 volts. Record the voltage shown in the power supply's display.

**Figure 3:** Power Supply Output Display



Please note that your instructor may ask to do this with a different voltage.)

Output voltage: \_\_\_\_\_

Connect the meter test leads to the output terminals of the power supply as shown in Fig. 4.

**Figure 4:** Connecting test leads to the power supply



The **black** test lead connected to the **black** or **(-)** terminal.

The **red** test lead connected to the **red** or **(+)** terminal.

Record the DMM range and voltage shown on DMM in Table 1.

Set the voltage range of the DMM to each range, for example 200 volts

Record the DMM range and the voltage displayed in the table below.

Successively set the DMM a lower voltage range and record the range and the corresponding voltage shown on the DMM in Table 1.

**Table 1**

| DMM DC Voltage Range       | DMM Voltage Displayed     |
|----------------------------|---------------------------|
| (record the units as well) | record the units as well) |
| _____                      | _____                     |
| _____                      | _____                     |
| _____                      | _____                     |
| _____                      | _____                     |
| _____                      | _____                     |

Turn off the power supply.

Using the selector switch on your DMM, select a DC voltage range of 20-volts.

Reverse the polarity of the test leads connected to the power supply. Refer to Fig. 5.



**Figure 5:** Leads connected in reverse



Connect the **black** test lead to the **(+)** or **red** terminal of the power supply

Connect the **red** test lead to the **(-)** or **black** terminal of the power supply.

Turn on the power supply and adjust it to 5-volts.

Record the value displayed by the DMM.

Displayed Value: \_\_\_\_\_

Reverse the polarity of the test leads and record the value displayed on the DMM.

Displayed Value: \_\_\_\_\_

Analysis: What changed when you reversed the polarity of the test leads?

\_\_\_\_\_  
\_\_\_\_\_

Remove the DMM test leads from the power supply terminals

Turn off the power supply.

Turn off the DMM.

**Analysis:**

1. Explain the accuracy displayed values as you lowered the voltage range on the multimeter's selector switch?
2. Explain the result when you tried to measure the voltage at a range lower than the value of the measured voltage?
3. Explain why is it a good idea to initially measure the voltage at the highest range of the meter?

## Section 6

# Electronics: Using a Multimeter to Measure Resistance

**Introduction:** To maintain or troubleshoot machines, one must measure the electric systems' properties. The tool used to do some of this work is the DMM (Digital Multimeter). To check performance of a circuit one must accurately find and read values of resistance in a circuit.

**Objective:** Learn how to use a DMM (digital multimeter) to measure resistance

### Equipment:

DMM (Digital Multimeter)

(2) test leads (1 red and 1 black)

1 kiloOhm resistor

### Procedures:

If you have not done so already, check your DMM and test leads. Refer to the lab exercise: *Using a Multimeter – Checking the Test Leads & the DMM* or ask the instructor for assistance.

**The DMM that you have may be labelled differently. If you have any questions, please ask your instructor.**

Turn on the DMM.

Set the selector switch to measure resistance which is indicated by  $\Omega$ .

Set it to the highest resistance range, for example 20M which is 20 Megaohms. Refer to the example shown in Fig. 1.

**Figure 1:** DMM resistance ranges





Connect the meter leads to the proper jacks on the DMM as shown in Fig. 2.

The **black** test lead should be connected to the **COM** or ground jack.

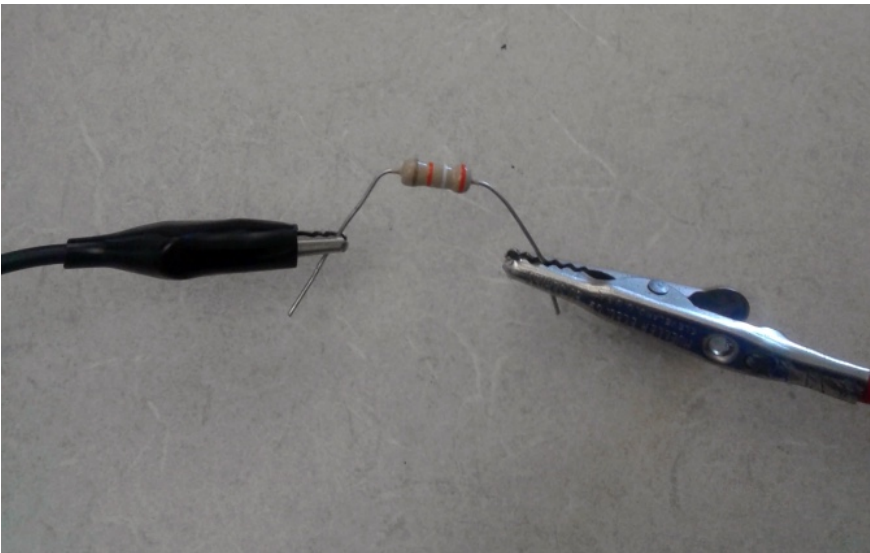
The **red** test lead should be connected to the **V/ $\Omega$**  jack.

**Figure 2:** Test lead jacks



Clip the test lead to each end of the resistor as show in Fig. 3.

**Figure 3:** Connecting the DMM test leads



Record the range, resistance, and the units ( $\Omega$ ,  $k\Omega$ , or  $M\Omega$ ) as shown on the display of the DMM in Table 1.

Set the set the range of the DMM to the next lowest range and repeat previous step.

Repeat the above steps for all of resistance ranges on the DMM.

Record the DMM range and the voltage displayed by the DMM in the table below.

**Table 1**

| DMM Resistance Range | Resistance Value Displayed | Units |
|----------------------|----------------------------|-------|
| _____                | _____                      | _____ |
| _____                | _____                      | _____ |
| _____                | _____                      | _____ |
| _____                | _____                      | _____ |
| _____                | _____                      | _____ |
| _____                | _____                      | _____ |

- 2. Explain the result when you tried to measure the resistance at a range lower than the resistance value of the resistor?
- 3. Is the measured resistance of the resistor that same as its nominal or labelled value? If it is not, explain why.

Circle range which provides the most accurate readout of the voltage.

Disconnect the DMM test leads from the resistor.

Turn off the DMM.

**Analysis:**

- 1. Explain what happens to the number decimal places of the displayed values as you lowered the resistance range on the multimeter’s selector switch.

# Create a Basic PLC Program

### Introduction:

Most industrial equipment operations must follow a specific sequence. The sequence of operation is typically controlled by a Programmable Logic Control (PLC) processor. This lab exercise is design to help students create a **simple** PLC program to control basic machine operation.

**Objective:** Using PLC software, students should create a **ladder logic program** to control a simple machine sequence.

### Equipment:

Basic PLC trainer with two push buttons and three lights.

The basic PLC lab has been designed to run on the most elementary PLC trainers. For this lab, we are only utilizing two push buttons and three lights.

Below are links for some low-level PLC trainers based on Allen-Bradley. But this is a basic PLC lab and it can be adapted to run on other PLC brands (e.g. Siemens or Omron).

- [MicroLogix 1000 PLC Trainer](#)

- [MicroLogix 1100 PLC Trainer](#)

- [Allen Bradley PLC Training Micrologix 1100 Trainer](#)

### Procedures:

A very common production sequence involves two main steps:

- First securing/clamping a part
- Then running an operation on the part

An example of such an operation is first clamping a part and then machining a hole using an industrial drill, or forming the part on a press brake, or spot welding parts together.

For this exercise, we will create a very simple fictional piece of equipment that will include two push buttons and three lights. For safety reason, we will use two push buttons to force operator to use both hands to start a sequence.

The first light will signify clamping a part. The second light will indicate running an operation (drilling) the part. The third light will show that drill motor is on.

Input / Output (I/O) list should be as follows (see the picture below):

**Inputs:**

Start Push Button 1 - PB #1

Start Push Button 2 - PB #2

**Outputs:**

Part Clamped Light - LED #1

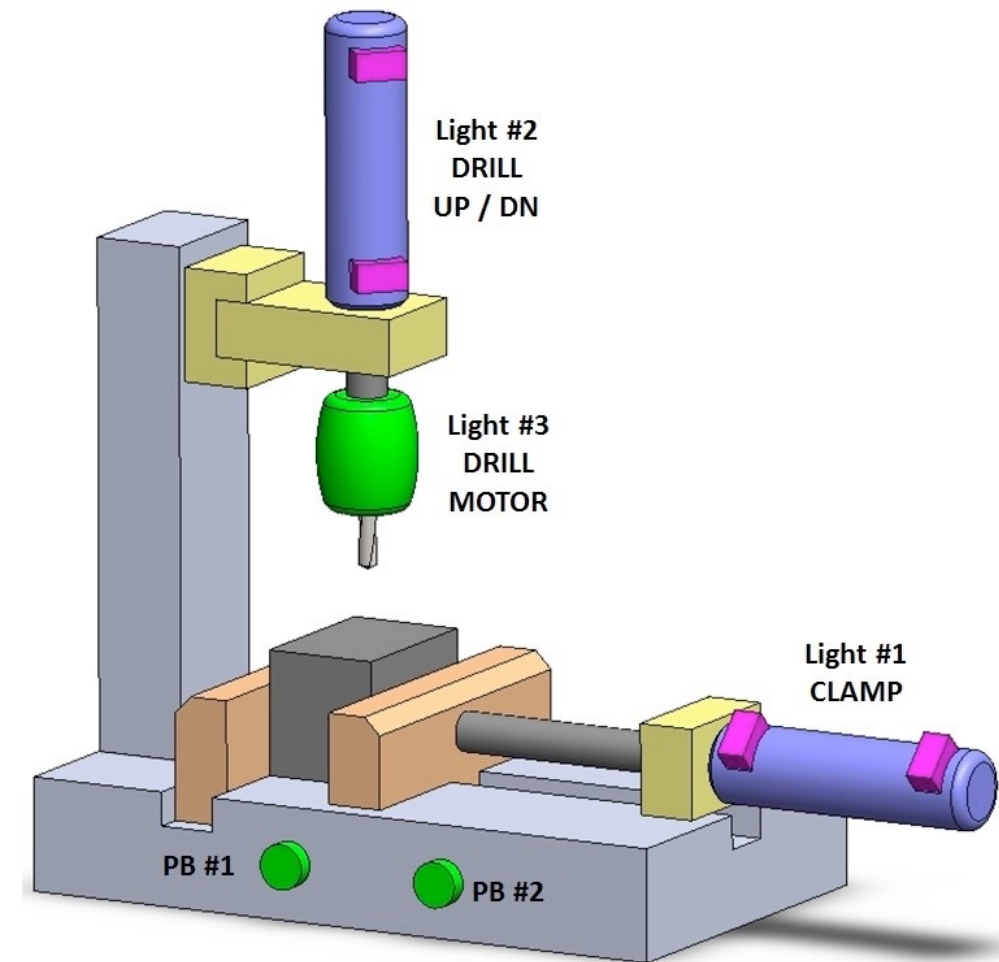
Drill Down Light - LED #2

Drill Motor ON Light - LED #3

The mechanical sequence of the machine:

1. Press **PB #1** and **PB #2** to activate the clamping device (turn ON **LED #1**),
2. After 3 seconds, turn on the drill motor and start the operation (turn ON **LED #2** and **#3**),
3. When the operation is done (5 seconds), turn off drilling motion (turn OFF **LED #2**),
4. Once the drill is in home position (2 seconds later), turn off the drill motor (turn OFF **LED #3**) and deactivate the clamp (turn OFF **LED #1**).
5. Once the clamp opens (**LED #1** turns OFF) and both **PB #1** and **PB #2** are open, the cycle is complete

**Figure 1:** Sketch of sample drill machine

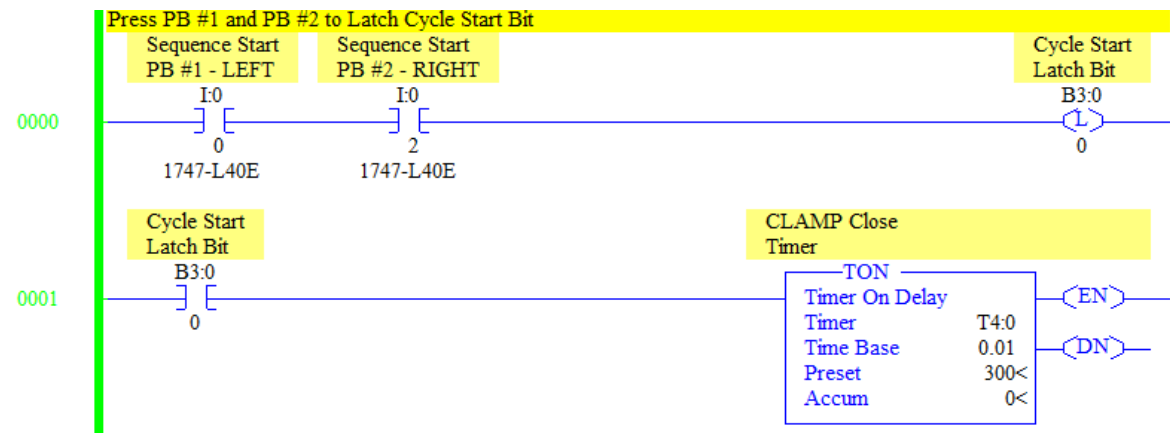


We will need to construct a PLC program with ladder rungs to perform the machine sequence as specified above. The ladder program is shown and explain below.

Rung #0 – Pressing **PB #1** and **PB #2** will latch the **Cycle Start Latch Bit (B3/0)**.

Rung #1 – The **Cycle Start Latch bit (B3/0)** activates **Clamp Close Timer (T4:0)**.

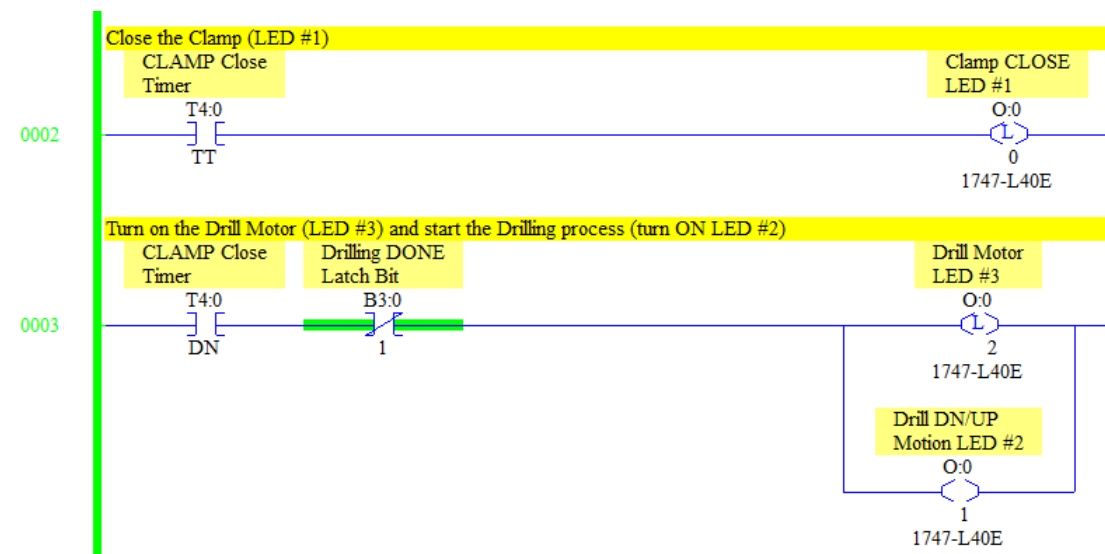
**Figure 2: Sample program (rungs 0-1)**



Rung #2 – Clamp Close Timer Timing (TT) bit turns on the **Clamp** (turn **ON LED #1**).

Rung #3 – After 3 seconds, Clamp Close Timer Done (DN) bit latches on the Drill Motor (turn ON **LED #3**) and starts the Drill Down Motion (turn ON **LED #2**). This input is shut off once the **Drill Down Latch Bit (B3/1)** activates.

**Figure 3: Sample program (rungs 2-3)**

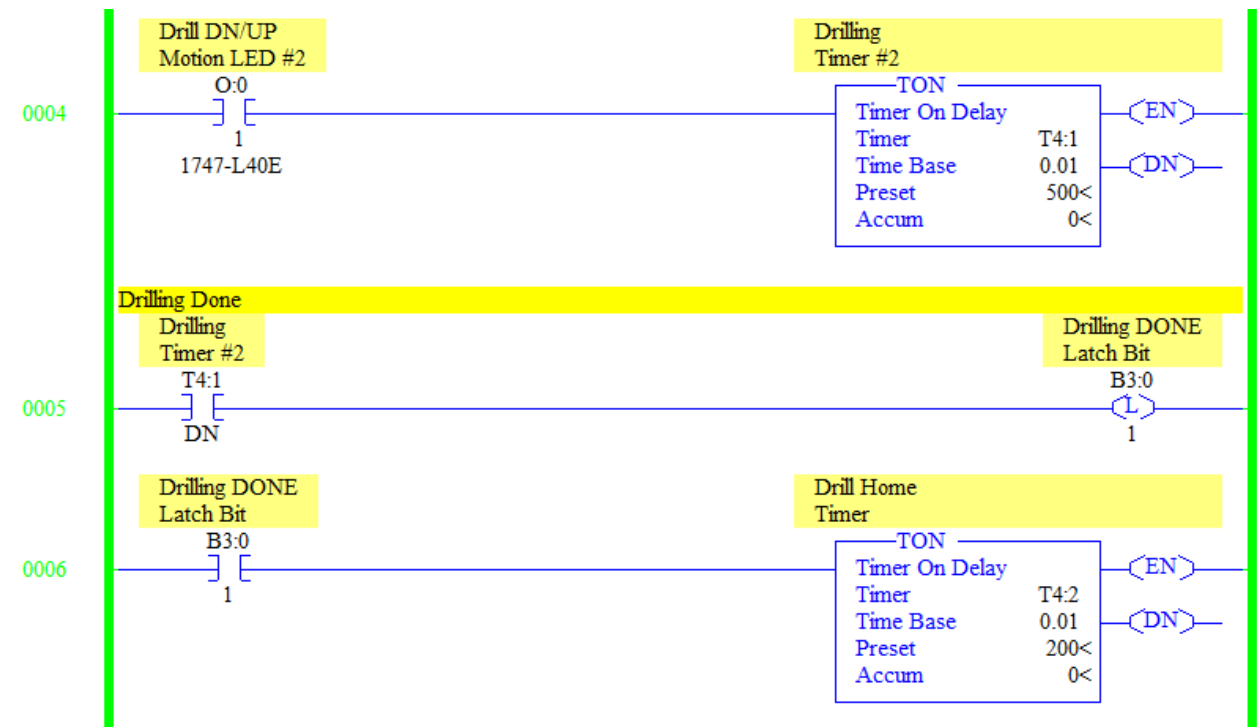


Rung #4 – Drill down motion (**LED #2 ON**) activates Drilling Timer (**T4:1**).

Rung #5 – After 5 seconds, Drilling Timer Done (DN) bit latches **Drilling Done Latch Bit (B3/1)**. Latching this bit will turn off Drill UP/DN Motion (turn OFF **LED #2**) in rung 3.

Rung #6 – Drilling Done Latch Bit (B3/1) activates **Drill Home Timer (T4:2)**.

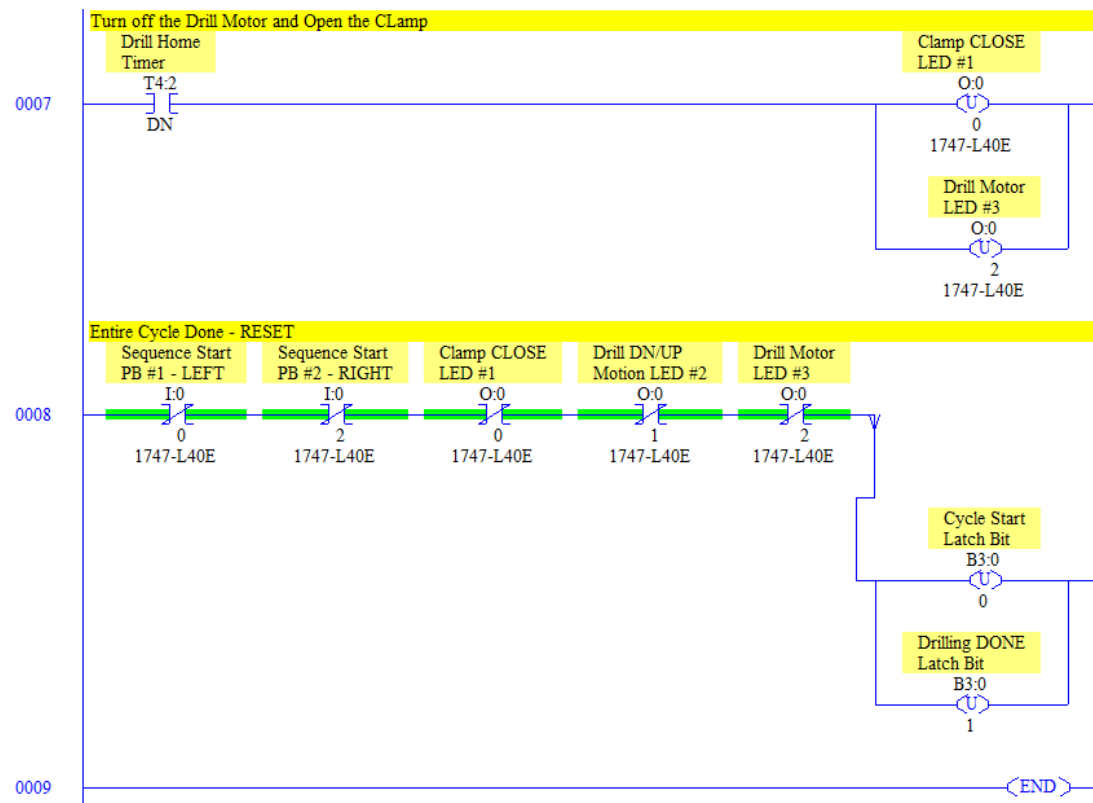
**Figure 4: Sample program (rungs 4-6)**



Rung #7 – Two seconds later, once the Drill Home Timer is done (drill in home position), the timer (DN) bit turns off the Drill Motor (unlatch **LED #3**) and opens the clamp (unlatch **LED #1**).



**Figure 5: Sample program (rungs 7-9)**



Rung #8 – This detects the end of cycle. It unlatches the two cycle latch bits **B3/0** and **B3/1** only if both start push buttons are open, the drill is up (**LED #2** is OFF), the clamp is open (**LED #1** is OFF), and drill motor is off (**LED #3** is OFF). This rung releases the cycle and allows the operator to start a new cycle.

### Analysis:

Students should check, and if necessary correct, their ladder logic program by downloading and testing a sequence on a physical PLC trainer.

### Conclusion:

Properly written PLC program can control an industrial equipment.

### References:

[Allen-Bradley - Programmable Controllers](#)

[Siemens - SIMATIC Controllers](#)

[Wikipedia - Programmable logic controller](#)

**Movie 3.5** Engineering Technology - Programmable Logic Controllers



Tap to view a video

# Create an Advanced PLC Program

### Introduction:

Most industrial equipment operation must follow specific sequences. The sequence of operation is typically controlled by a Programmable Logic Control (PLC) processor. This lab exercise is designed to help students create a complex PLC program to control advanced machine operation. It includes OSHA anti-tie down circuit and cycle too long alarm timer.

**Objective:** Using PLC software, students should create a **ladder logic** program to control a simple machine sequence.

### Equipment:

Advanced PLC trainer with motion devices.

For this lab, we are utilizing more advanced PLC trainers with motion elements including two cylinders and two electric motors. If the specific trainer does not have all the specified devices, some of the motion components might be substituted with a lights e.g. turning on an electric motor can be substituted by turning on an LED.

Below are links for some more advanced PLC trainers based on Allen-Bradley.

- [Miniature Machine - Ultimate PLC Trainer - Conveyor Part Detection - Electrical Training - Allen Bradley](#)
- [Amatrol - Portable PLC Learning System 990-PABCL1F](#)

### Procedures:

A very common production sequence involves two main steps:

- First securing/clamping a part
- Then running an operation on the part

An example of such operation is first clamping a part and then machining a hole using industrial drill, forming the part on a press brake, or spot welding parts together.

For this exercise we will create a more advanced machine that will include four motion devices (two double acting cylinders and two electric motors). For safety, we will create an anti-tie down

circuit to force operator to press both push button simultaneously (within one second).

Two cylinders will indicate a clamping device (clamp close and clamp open) and movement of the operation device (drill up and down motion). Two electric motors will represent spinning of operation device (e.g. drill motor) and lubricating/cooling pump.

Input / Output (I/O) list should be as follows (see the picture below):

#### Inputs:

Sequence Start Push Button Left - **PB #1**

Sequence Start Push Button Right - **PB #2**

Alarm RESET Push Button - **PB #3**

Cylinder #1 Return Limit Switch - **Clamp Open (RET LSW)**

Cylinder #1 Extend Limit Switch - **Clamp Close (EXT LSW)**

Cylinder #2 Return Limit Switch - **Drill UP (RET LSW)**

Cylinder #2 Extend Limit Switch - **Drill DN (EXT LSW)**

#### Outputs:

Electric Motor #1 - **Drill Motor**

Electric Motor #2 - **Pump Motor**

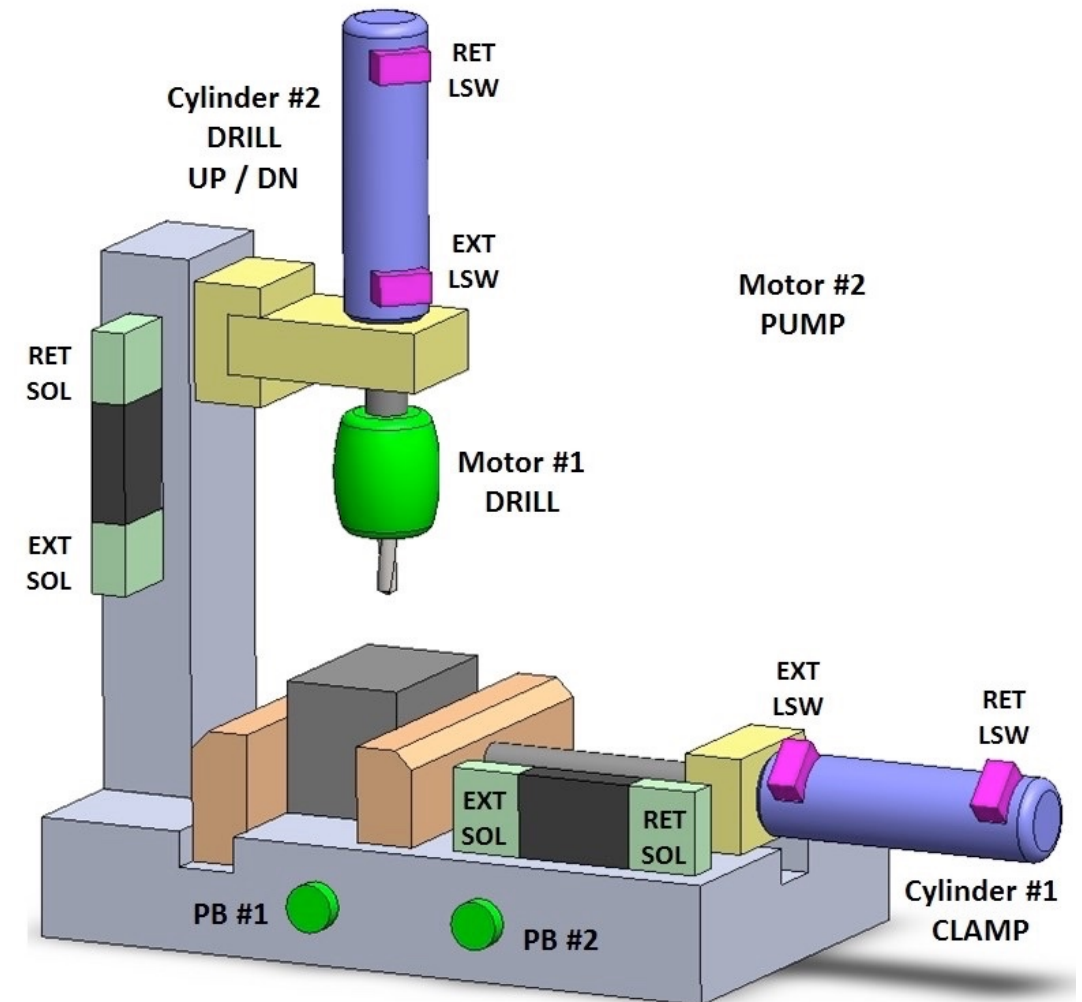
Cylinder #1 Return Solenoid - **Clamp Open (RET SOL)**

Cylinder #1 Extend Solenoid - **Clamp Close (EXT SOL)**

Cylinder #2 Return Solenoid - **Drill UP (RET SOL)**

Cylinder #2 Extend Solenoid - **Drill DN (EXT SOL)**

**Figure 1:** Sketch of sample drill machine



#### The mechanical sequence of the machine:

1. Press **PB #1** and **PB #2** simultaneously (within one second) to clamp the part and start the drill motor (turn ON **Clamp Close SOL** and **Drill Motor**).

2. Once clamp is closed (**Clamp Close LSW** turns ON), start drilling and lubricating / cooling (turn ON **Drill DN SOL** and **Pump Motor**).
3. Run the lubricating/cooling pump (keep ON **Pump Motor**) for three additional seconds past the drill cycle done (**Drill DN LSW**).
4. Once the drilling process is done (**Drill DN LSW** turns ON), return the Drill to up position (turn ON **Drill UP SOL**).

**Note: If the cycle takes too long (e.g. broken or dull drill), return the drill to the up position, stop the drill motor, and activate alarm light.**

5. Once the drill returns (**Drill UP LSW** turns ON), turn off the drill (turn OFF **Drill Motor**), and open the clamp (turn ON **Clamp Open SOL**).
6. Once the clamp opens (**Clamp Open LSW** turns ON) and both **PB #1** and **PB #2** are open, the cycle is complete.

We will need to construct a PLC program with ladder rungs to perform the machine sequence as specified above. The ladder program is shown and explained below.

Rung #0, rung #1, and rung #2 are part of the anti-tie down function to comply with OSHA safety regulations (both cycle start

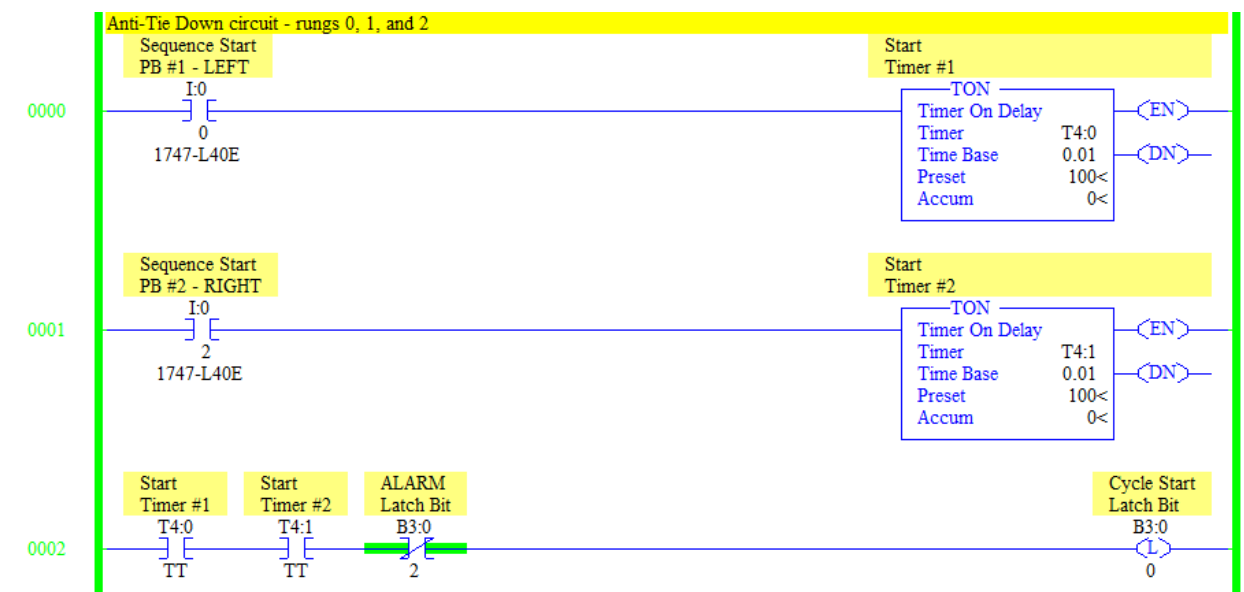
push buttons must be pressed simultaneously to start each cycle).

Rung #0 – Pressing **PB #1** activates **Start Timer #1**.

Rung #1 – Pressing **PB #2** activates **Start Timer #2**.

Rung #2 – This will latch the **Cycle Start Latch Bit (B3/0)** only if there is no alarm and both push buttons are pressed within the one second time window (timer TT bit is only ON for timer duration/preset value). Note that if either push button is pressed too slowly or is tied down, both buttons must be released and pressed again to get the cycle started.

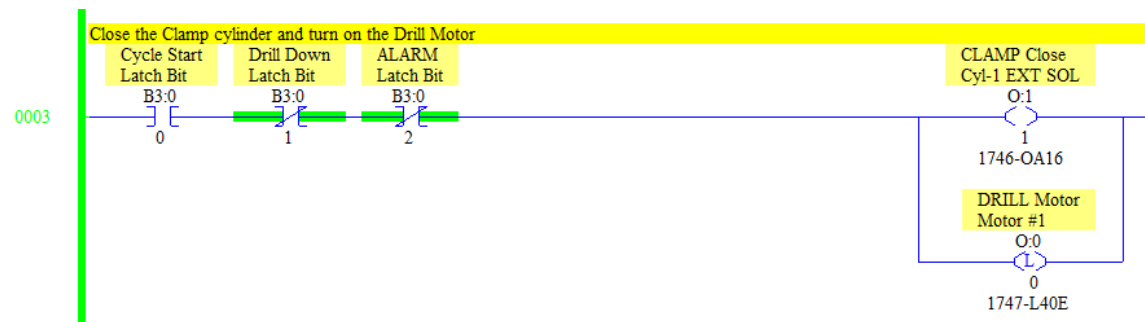
**Figure 2: Sample program (rungs 0-2)**



Rung #3 – If the cycle start latch bit is on (B3/0), there is no alarm, and the drill has not been down yet (B3/1 not); the rung closes

the clamp (turns ON **Clamp Close SOL**) and latches the drill motor (turns ON **Drill Motor**). The Drill Down Latch Bit (B3/1 not) element is necessary to release the clamp close solenoid and drill motor since the B3/0 bit will still be on when we want to release the clamp and turn off the drill motor.

**Figure 3: Sample program (rung 3)**

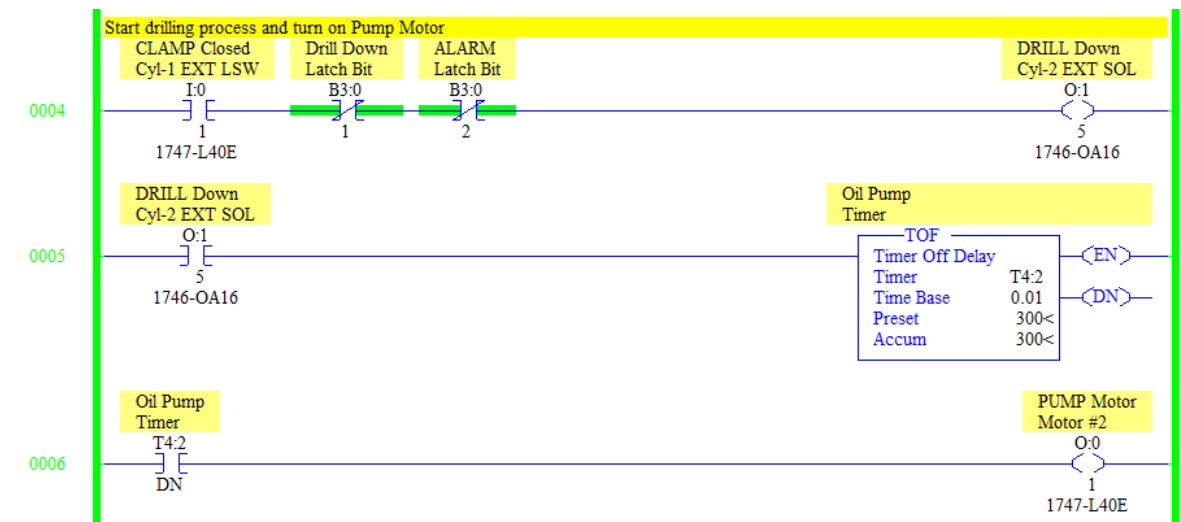


Rung #4 – Once the clamp is closed (**Clamp Close LSW** turns ON), the rung starts the drill down motion (turns ON **Drill DN SOL**). This output is shut off once the Drill Down Latch Bit (B3/1) or Alarm Latch Bit (B3/2) activates.

Rung #5 – This starts the Oil Feed Timer. This TOF timer will start the pump motor as soon as drilling starts, and keep it on for the required three additional seconds.

Rung #6 – This turns on the oil feed motor (turns ON **Pump Motor**) output for as long as the Oil Feed Timer Done (DN) bit is on.

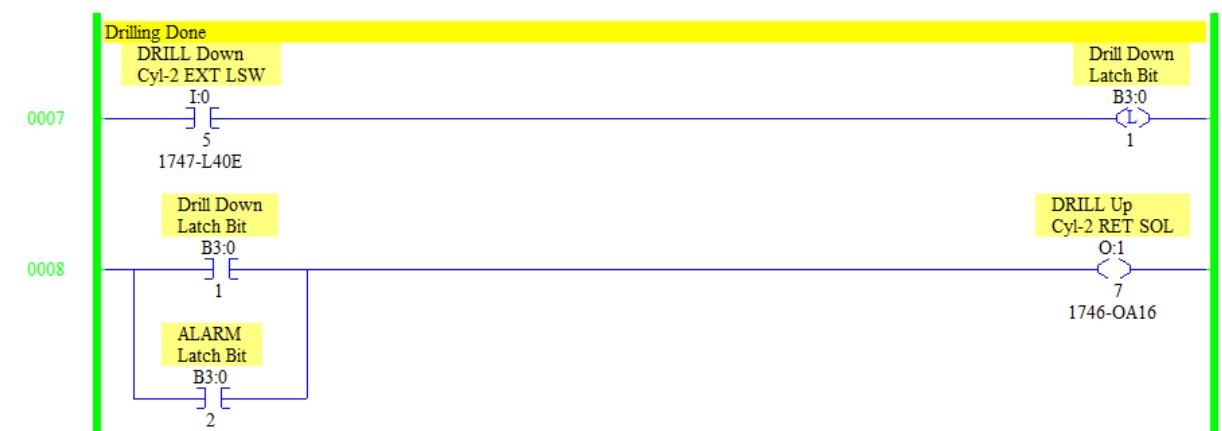
**Figure 4: Sample program (rungs 4-6)**



Rung #7 – This latches the **Drill Down Latch Bit (B3/1)** when the drilling process is done (**Drill DN LSW** turns ON). It is important that this bit is latched, as the Drill DN LSW will release as soon as the drill head begins to move up.

Rung #8 – This starts backing up the drill (turns ON **Drill UP SOL**) when the Drill Down Latch Bit (B3/1) has been set or the Alarm Latch Bit (B3/2) comes up.

**Figure 5: Sample program (rungs 7-8)**





Rungs 9 through 12 are used to set Alarm if the cycle takes too long (over 10 seconds).

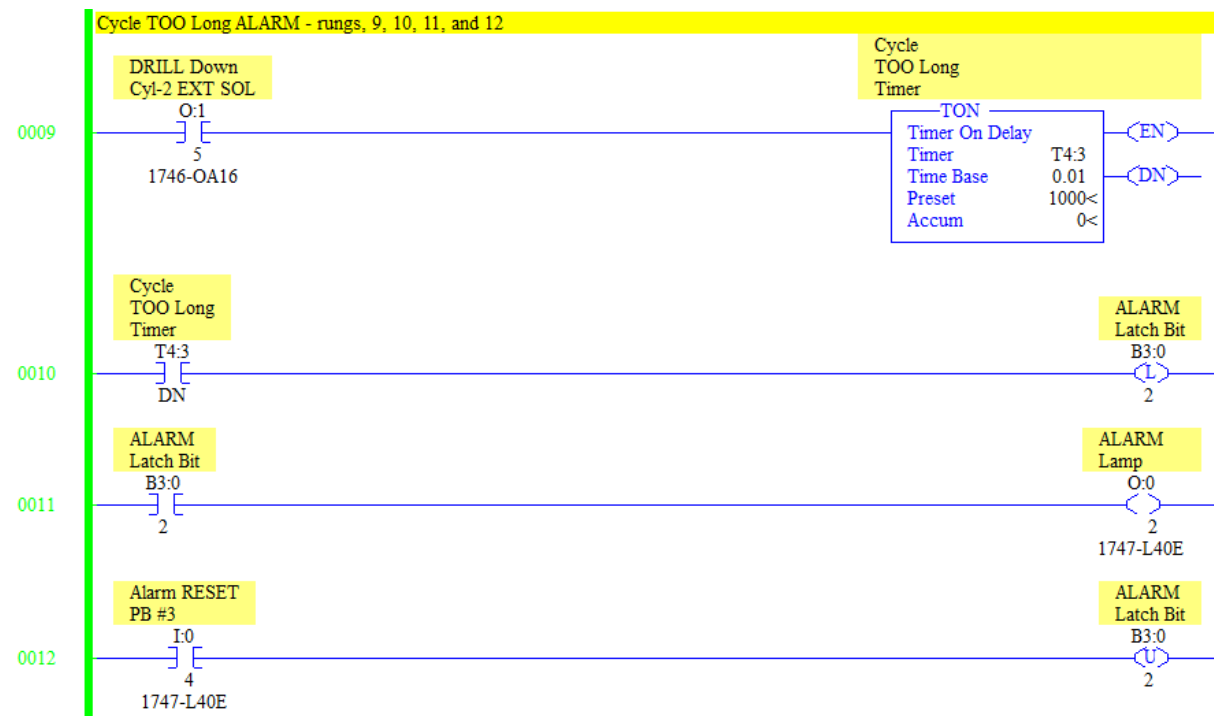
Rung #9 – This is used to time the length of the drill down cycle. During normal operation, the timer should always reset before the time out preset time elapses (set to 10 seconds).

Rung #10 – This latches the Alarm Bit B3/2 if the T4:3 timer times out (T4:3 DN bit activates).

Rung #11 – This turns on the Alarm Lamp if the Alarm Latch Bit (B3/2) is set.

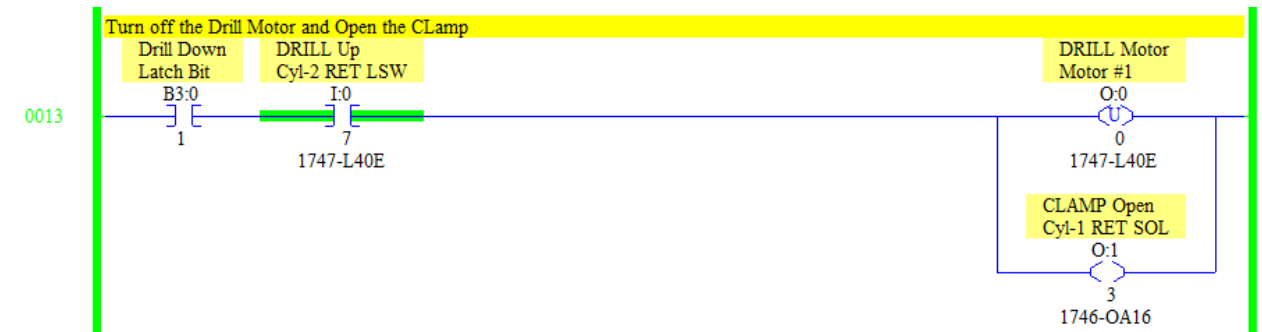
Rung #12 – This unlatches the Alarm Latch Bit if the alarm reset push button (**PB #3**) is pressed.

**Figure 6:** Sample program (rungs 9-12)



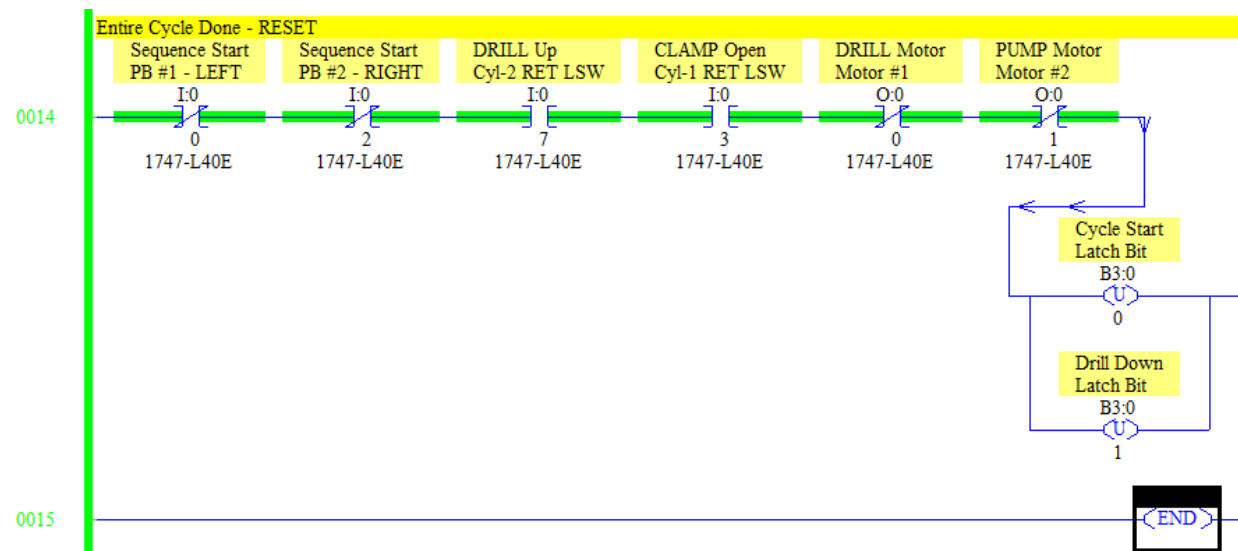
Rung #13 – Once the drill is in the up position (**Drill UP LSW** turns ON) and the Drill Down Latch Bit (B3/1) is set, the rung turns off the drill and opens the clamp (unlatch **Drill Motor** and turn ON **Clamp Open SOL**).

**Figure 7:** Sample program (rung 13)



Rung #14 – This detects the end of cycle. It unlatches the two cycle latch bits **B3/0** and **B3/1** only if both start push buttons are open, the drill is up, the clamp is open, and both motors (drill and pump motors) are off. This rung releases the cycle and allows the operator to start a new cycle.

**Figure 8:** Sample program (rungs 14-15)



### Analysis:

Students should check, and if necessary correct, their ladder logic program by downloading and testing a sequence on a physical PLC trainer.

### Conclusion:

Properly written PLC program can control an industrial equipment.

### References:

[Allen-Bradley - Programmable Controllers](#)

[Siemens - SIMATIC Controllers](#)

[Wikipedia - Programmable logic controller](#)

## **Movie 3.6** Engineering Technology - Programmable Logic Controllers



Tap to view a video

# Scanning and Optical Sensors: Identifying Tag Types

**Objective:**

To become familiar with the various tag types and their uses.

**Equipment:**

(1) RFID Tag Identification Display Board containing (7) tags

**Procedures:**

1. Five of the seven tags numbered 1 through 7 are manufactured by Intellitag (two of the tags are label tags from the zebra printer). [Identify them.](#)

**Figure 1:** RFID Tag Identification Display Board



| Tag # | Tag Name | Tag Type | Read Range |
|-------|----------|----------|------------|
|       |          |          |            |
|       |          |          |            |
|       |          |          |            |
|       |          |          |            |
|       |          |          |            |

For each of the five Intellitag products, list the tag name, tag type and frequency range.

2. Based on the data sheet, which of Intellitag's tags exhibits the best distance for reading if attached to cardboard?
3. What is the operating temperature range in degrees Fahrenheit for the windshield sticker tag?
4. What is the frequency and read range for the container tag?
5. Which of the tag types are designed for maximum range performance in open air?
6. If you had to mount a tag directly on a metal surface, which tag would you pick for maximum read distance?
7. What is the read range and frequency for the ID card?
8. Which tag has the smallest operating temperature range?
9. Identify three differences between the "container tag" and the "reusable container tag".
10. Which of the container tags has the best read range if mounted with a .125 stand-off on a metal surface?
11. Which of the tag types would be most appropriate for a rugged environment when used on a work in process?
12. Why might you not want to use a self stick tag type in a cold storage environment?

13. Five of the sample tags have visible antenna patterns.  
Choose three of these tags and draw their antenna patterns in the space below.

| Tag # | Antenna Pattern |
|-------|-----------------|
|       |                 |
|       |                 |
|       |                 |

# Scanning and Optical Sensors: Activating an RFID Tag

### Objective:

To investigate the wave signals that an RFID tag receives to charge its power source and the signals it then transmits back to the reader. Viewing the change in signal strength that occurs as the tag is moved closer to or farther away from the reader antenna. Viewing the effective wave shapes if more than one tag is present in the read field.

### Equipment:

Oscilloscope, for example BK precision Model number 2120B

Function Generator, for example Elenco GF 8056

Handheld RFID tag reader, for example Symbol Model number MC9090R6

RFID tags, for example [Intellitag models](#)

Tape measure

### Procedures:

1. Power up the scope and signal generator at your lab position.
2. Connect the cable from the scope's Channel 1 input to the output of the signal generator. Red clip to red clip, Black clip to black clip. Be sure they don't short to each other.
3. Set the signal generator to sine wave output with frequency of 100k hertz .
4. Adjust the frequency knob until you get approximately 100 k hertz on the display. See Figure 1.

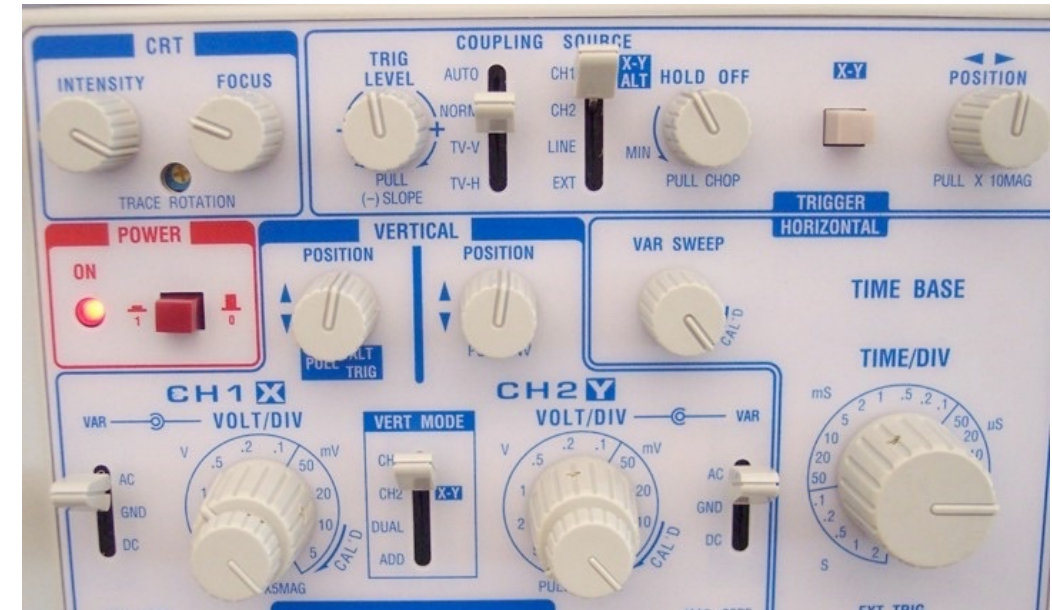


**Figure 1:** AC Signal Generator with 101.11 k hertz frequency



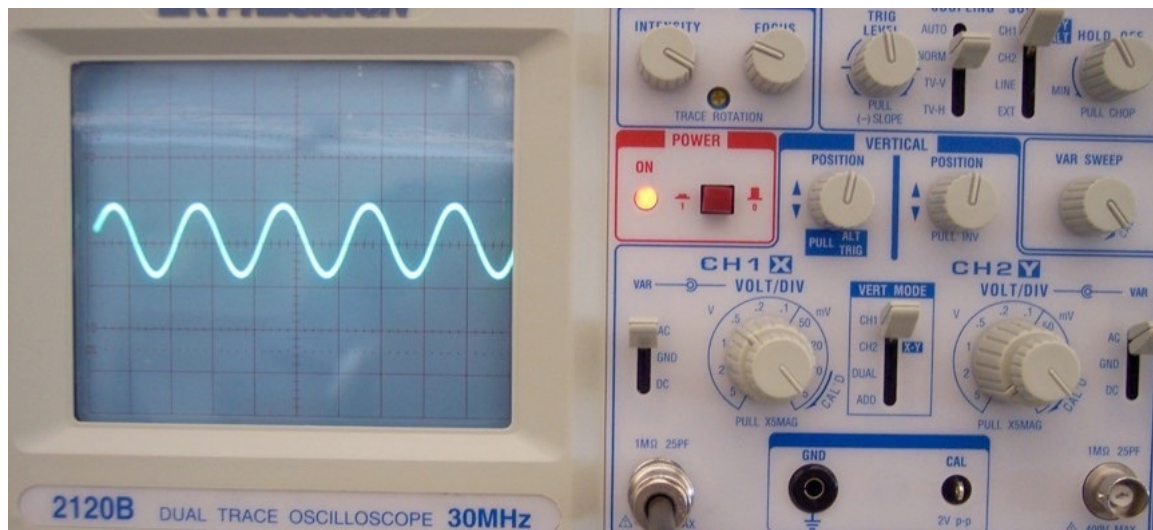
5. Set the scope channel 1 voltage level to 0.5v per div, AC input, and the time base to 5  $\mu$ s.
6. Set the trigger coupling to Normal. See Figure 2.

**Figure 2:** Oscilloscope with the 0.5v per div and the time of 5  $\mu$ s



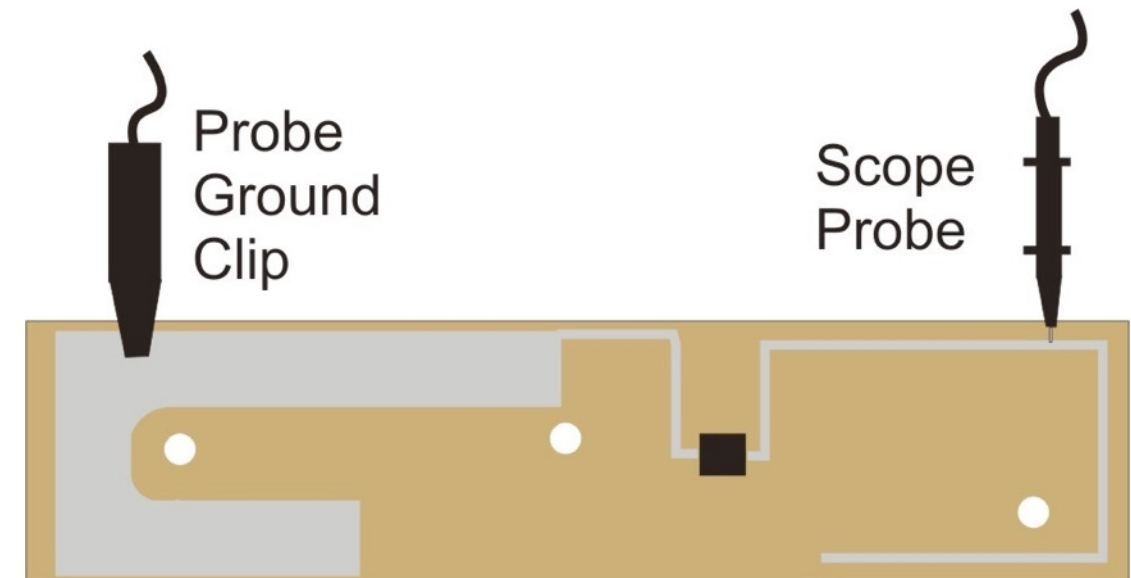
7. Adjust the trigger level knob until you get a sign wave on the screen. Make sure trace is centered on the screen.
8. Adjust the output level from the signal generator until the signal fills about 2 vertical divisions on the scope screen. See Figure 3.

**Figure 3:** Output of Signal Generator

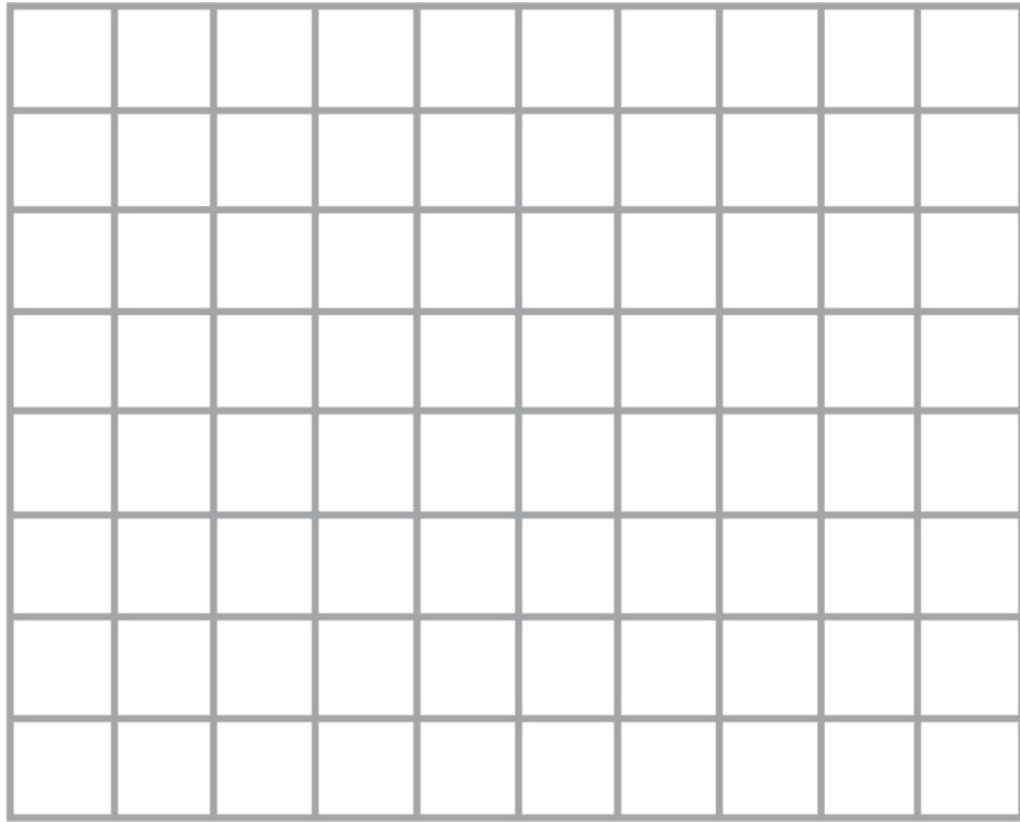


9. Notice that moving the trigger level changes where the trace starts.
10. Move the time base knob in each direction and record the changes that you observe on the screen.
11. Practice adjusting the generator and scope until you feel comfortable with the instruments.
12. Remove the signal generator clips from the scope leads.
13. Connect the scope leads to the RFID tag included with your lab setup as shown below in Figure 4.

**Figure 4:** RFID tag with the scope leads



14. Adjust the scope time base to 20 msec and the channel 1 input level to 0.5v / div.
15. Using the handheld tag reader click the trigger button with the reader about 2" to 4" away from the tag.
16. Record the wave shape that you see below. You may have to trigger the read several times to get the trace pattern correctly. Always wait about 10 seconds before triggering the tag again. Be sure the hand reader indicates a tag was read.

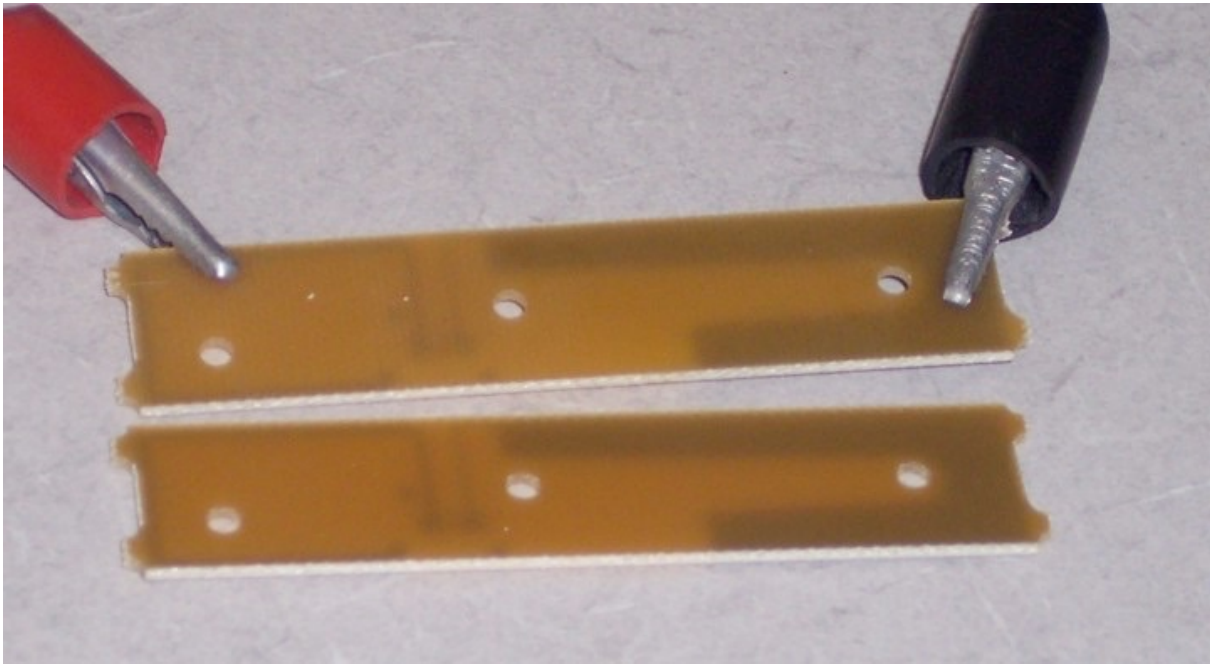


17. Move the handheld reader away from the tag about 1 to 1.5 feet, or until the reader signals no tags read. What change do you see in the scope signal shape? Draw the new signal below.



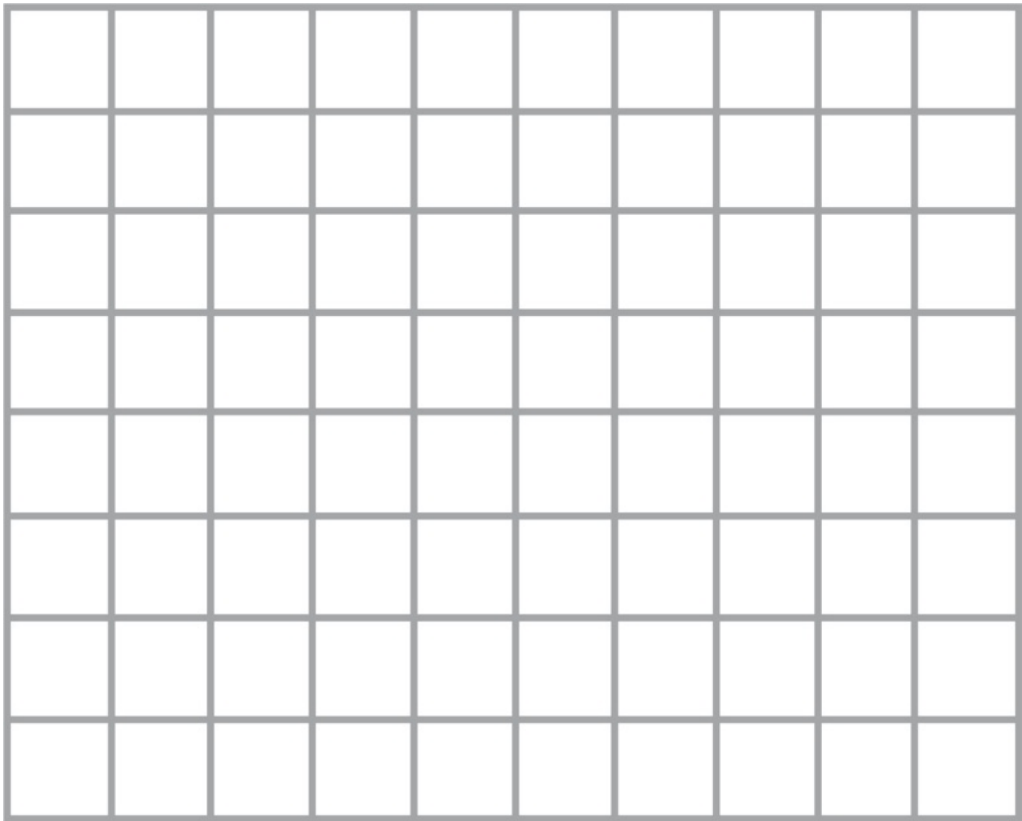
18. Move a second tag close to the tag you have wired to the scope as is displayed in Figure 5. Trigger the handheld reader and be sure it reads both tags. Do you see a difference in the signal you are observing on the screen? See Fig 5.

**Figure 5:** Second Tag Placed Close to the Wired Tag



20. Compare your last drawings of the output signal. Why do you think the signal is so much longer?

19. Draw the new scope trace below.





# Shielded Metal Arc Welding Lab - Basic

## Introduction:

Shielded metal arc welding (SMAW) is a welding process that uses an electrode covered with flux to lay the weld. Electric current, in the form of either alternating current AC or direct current DC from a welding power supply is used to form an electric arc between the electrode and the metals to be joined. The metal work piece and the electrode melts forming a pool of molten metal that cools to form a joint.

Because of the flexibility of the process and the basic nature of the equipment and operation, shielded metal arc welding is one of the most popular welding processes. It provides a way to quickly repair metal and maintain equipment like conveyors, metal shelving and other metal items.

**THIS EXERCISE CAN BE EXTREMELY DANGEROUS. ALL SAFETY PRECAUTIONS AND PRACTICES MUST BE FOLLOWED.** *Note: The authors, publishers or sponsors of this book assume no responsibility or liability for these activities.*

**Objective:** Provide students with entry level skills in shielded metal arc welding and to practice a basic weld by producing a pad of surfacing welds

## Equipment:

Basic Stick (SMAW) welder

Welder – Shielded Metal Arc Welder

Power Source – 120 or 240 Volt receptacles

Protective Clothing, Gloves and Helmet

## Safety Equipment & Tools:

You will need the following safety equipment and tools for this exercise. Note that these activities involve extreme heat and burning gases. There will be **extreme brightness, a risk of fire and the resulting gases can be toxic for the respiratory system**

- Nonflammable welding jacket or welding leathers



- Safety glasses with side shields
- Welding helmet with proper lens shades based on welding amperage
- Steel-toed safety boots
- Work pants without cuffs
- Heavy duty leather gloves
- 1 pair of pliers for handling hot parts
- 1 wire brush
- 1 chipping hammer

#### **Procedures:**

Operation of a Shielded Metal Arc Welder requires:

- An understanding of the safety precautions and equipment for arc welding
- Overview of the shielded metal arc welding process, equipment and applications

**Figure 1:** Welding Helmet



- Essential concepts of shielded metal arc welding and the quality of welds
- Striking and controlling an Arc Weld

A welder can be used to repair equipment and maintain material moving equipment.

An example of this type of operation is welding metal parts together to create a basic weld joint.

**Figure 2:** Proper safety gear when performing a weld using stick welding equipment (SMAW) is an important part of the job.

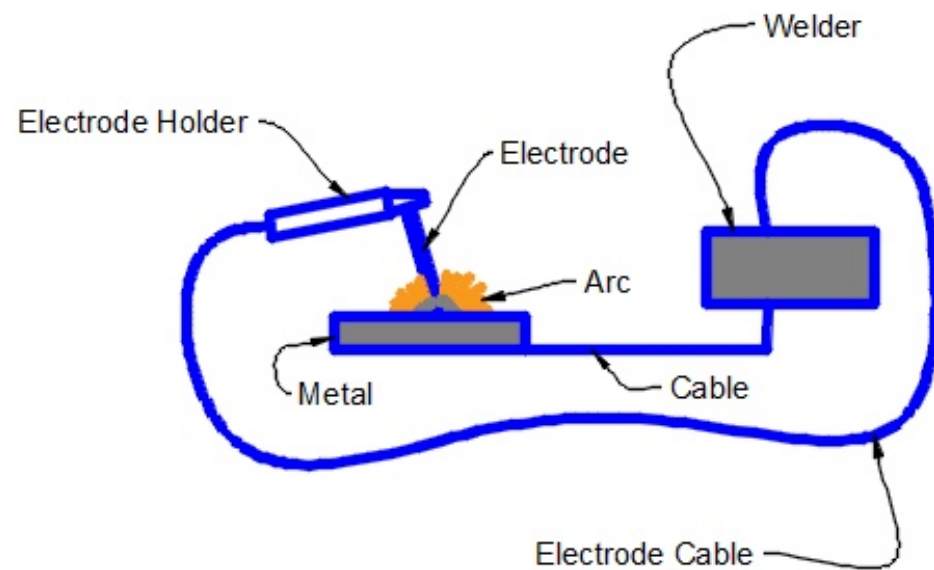


## Fundamentals of Shielded Metal Arc Welding (SMAW):

Shielded metal arc welding is widely used because of its versatility and portability.

The welding circuit consists of a power source that supplies high current/low voltage power to produce the arc, an electrode lead with an electrode holder. An electrode and work lead with work clamp to complete the circuit.

**Figure 3:** SMAW Stick Welding Machine Parts and terminology.



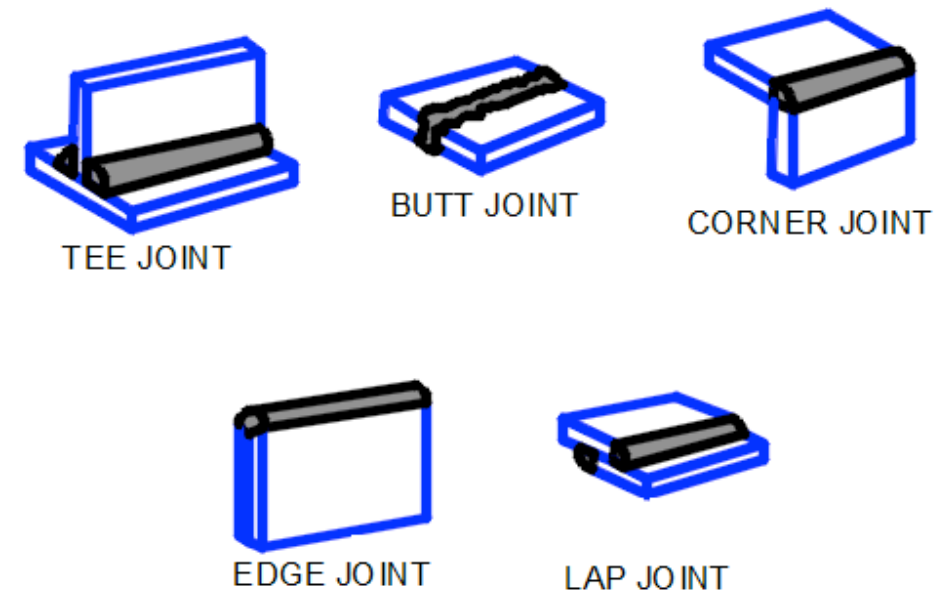
When you touch the electrode to the surface of the work piece, voltage causes current to form an arc across the gap between the tip of the electrode and the work.

### Basic types of weld joints

A welding joint is a point or edge where two or more pieces of metal are joined together.

They are formed by welding two or more metal pieces according in standards for different joints

**Figure 4:** Basic Welding Joints

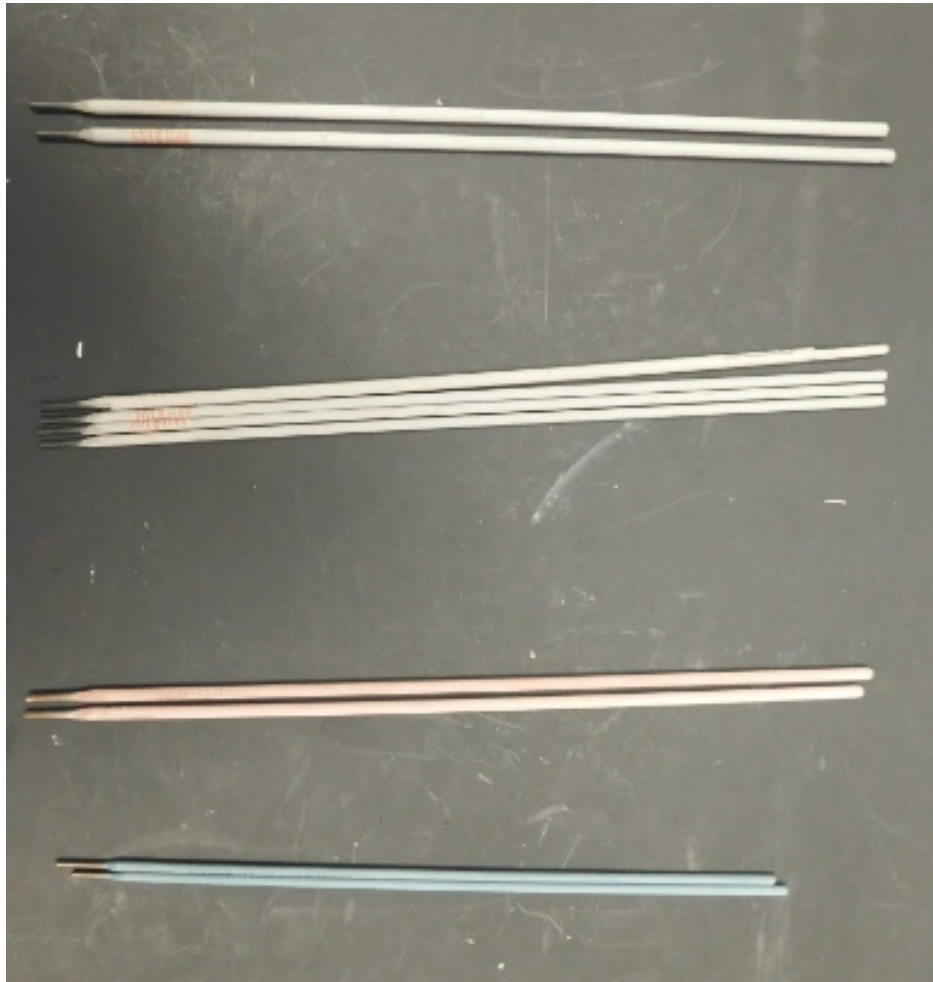


### Essentials of shielded metal arc welding:

1. Electrode Diameter
  - a. Electrode diameter is based on the thickness of the base metal, the welding position and the type of joint to be welded. Larger diameter electrodes are used on thicker metals and for flat position welding because they offer higher deposition rates.

- b. Smaller diameter electrodes are used for horizontal, vertical and overhead welding, because they produce a smaller weld puddle that is easier to control.

**Figure 5:** Welding Electrodes



## 2. Current

Current is measured in amperes, or amps. Each type of electrode has recommended amperage ranges for optimum performance.

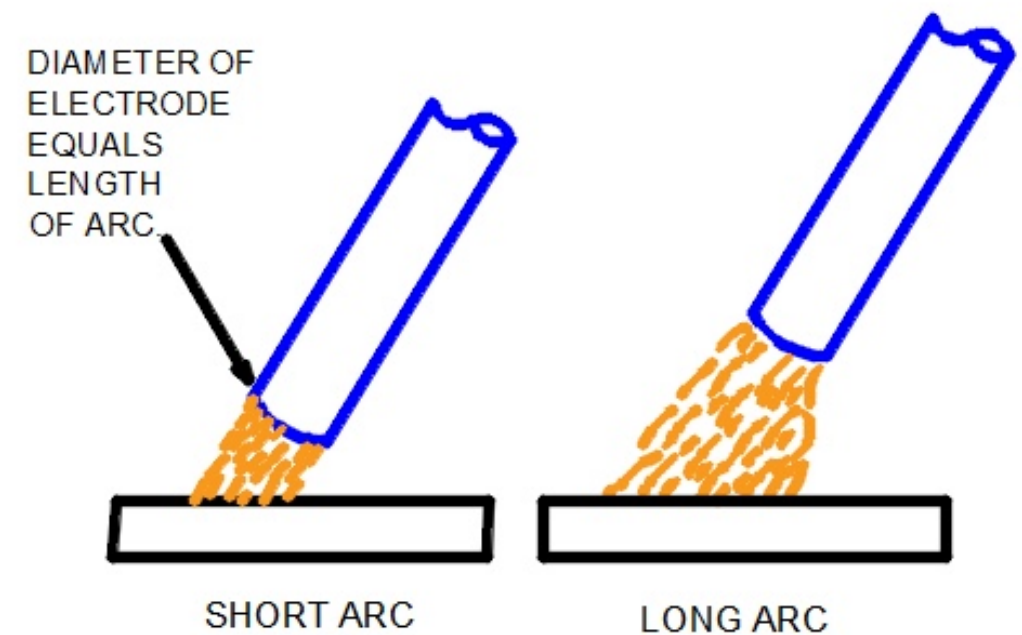
**Figure 6:** Stick Welding Electrodes - Classification Codes



## 3. Arc Length and Electrode Angle

Arc length is the distance from the tip of the electrode core wire to the weld puddle. When welding, the work and travel angles are used to control the weld puddle and penetration.

**Figure 7:** Examples of Arc Length

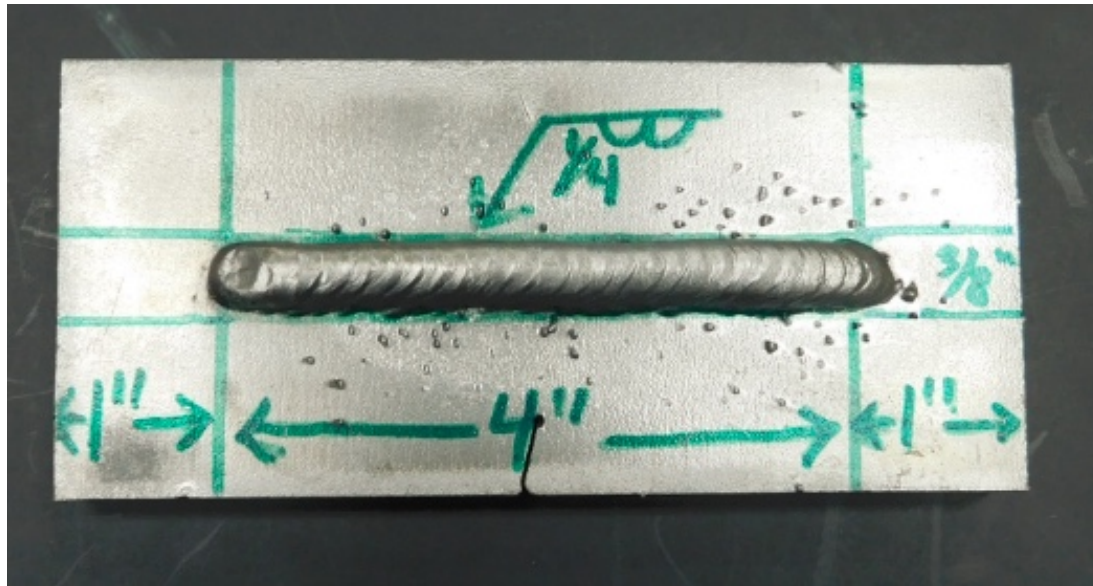


## 4. Travel Speed



Travel speed is the rate at which the electrode moves along the work. The key to correct travel speed is reading the weld puddle. If you travel too slowly, the weld metal piles up forming a high, wide weld-bead.

**Figure 8** Example of proper weld bead.



### Hands-On Lab:

Equipment: Welder – Shielded Metal Arc Welder

Power Source – 120 or 240 Volt receptacles

Protective Clothing, Gloves and Helmet, chipping Hammer and Wire Brush (See Above)

#### 1. Materials & Machine Settings

- a. Base Metal: 2" x 6" x 1/4" mild steel plates

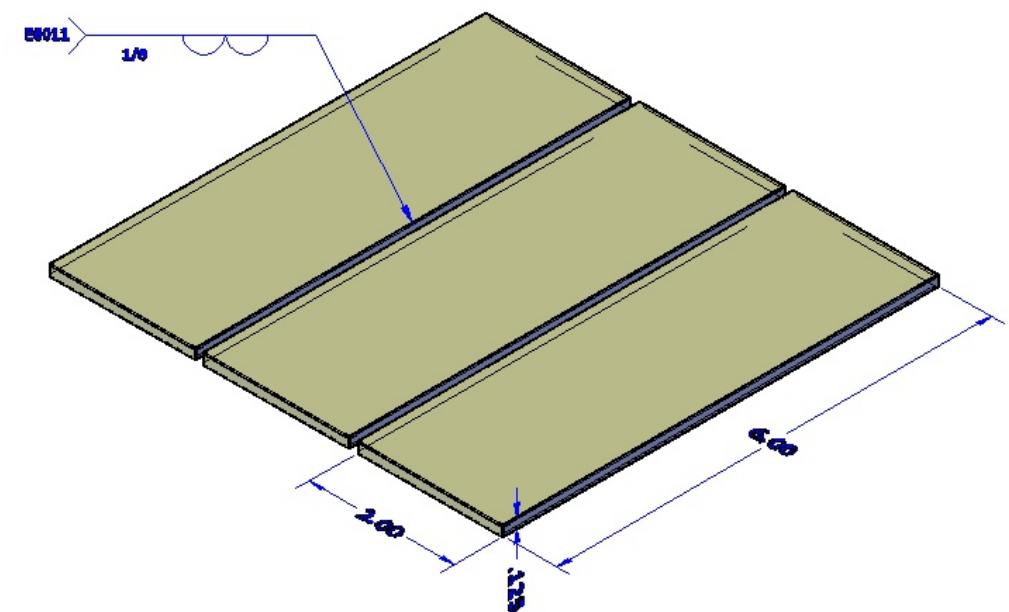
- b. Electrodes: 1/8" E6011

- c. Polarity: DCEN (straight polarity)

- d. Amperage: 80-125

Input / Output (I/O) list should be as follows (see the picture below):

**Figure 9:** Metal Plate to be welded



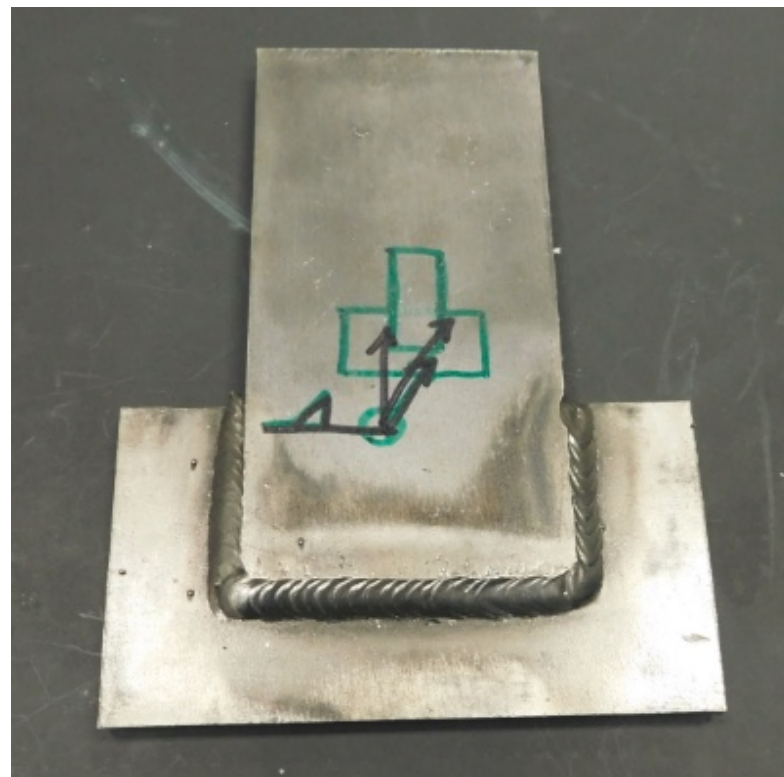
#### 2. Make Welds

Butt Welds

**Figure 10:** Butt Weld Example



**Figure 11:** Example of Fillet Weld around a contour.



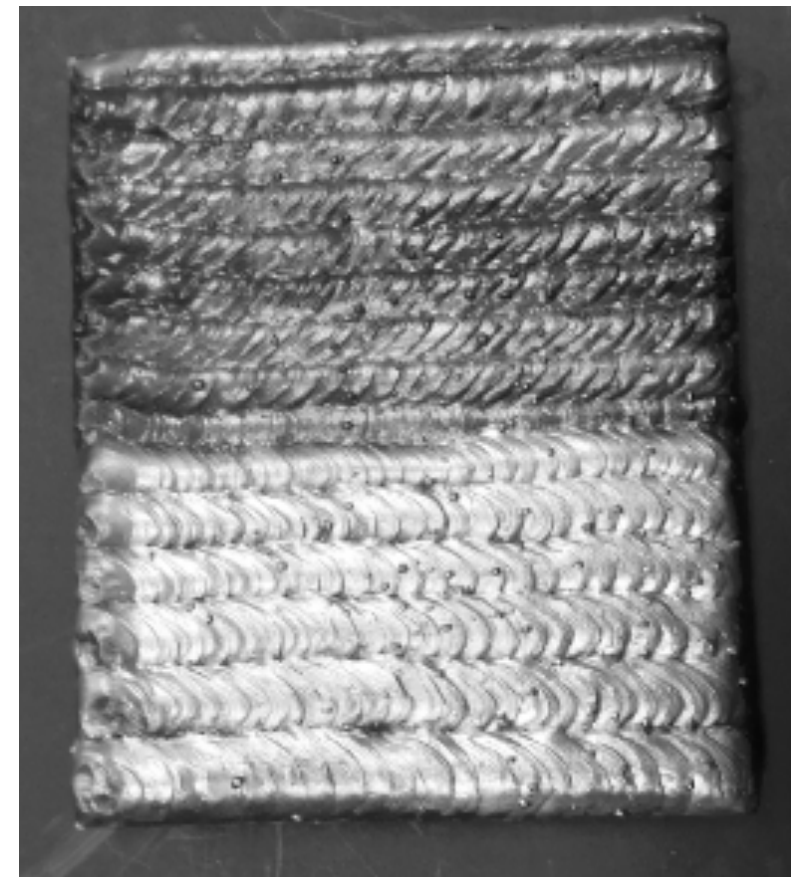
Filet Weld around a contour

3. Remove slag and brush weld after each pass.
4. Make remaining welds with the same electrode angles.
5. Overlap 1/3 to 1/2 of previous bead.

**Analysis:**

Inspect welds.

**Figure 12:** Overlapping Weld Practice



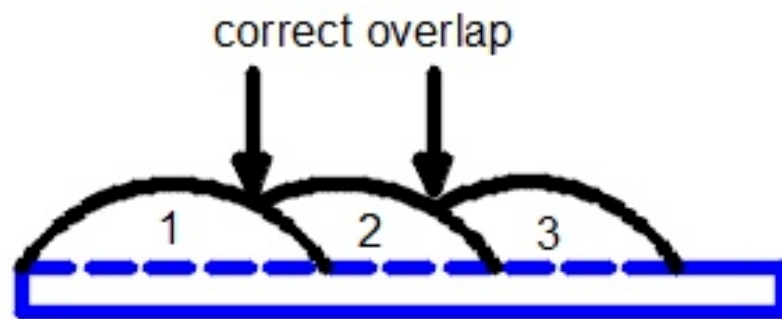


**Figure 13:** More Overlapping Weld Practice

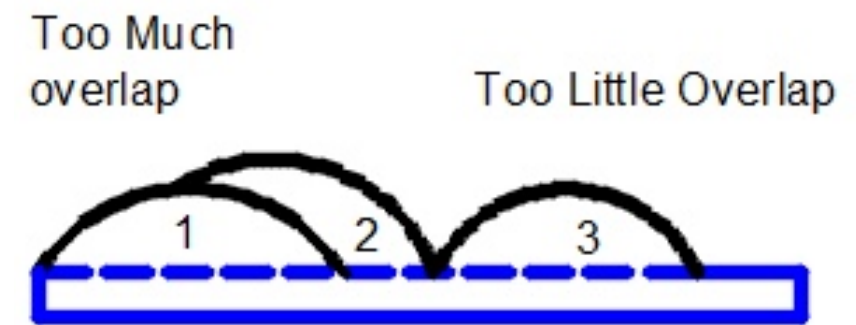


Surface should be flat with a consistent ripple pattern.

**Figure 14:** Example of Correct Technique



**Figure 15:** Example of Incorrect Technique



# Workplace Communications Active Listening Lab Exercise

**Introduction:** In this lab you will learn about the importance of active listening and the role it plays in achieving more effective workplace communications and, in fact, in communications outside of the work place as well with friends, families and social situations. In the first video, you will learn what active listening will help you accomplish. You'll also learn that although it sounds deceptively simple, "listen to what the other person is saying;" in fact, it requires great effort and practice to achieve the highest level of this skill. There is a reference to a short video showing Carl Rogers, founder of Client-Centered Therapy on the importance he places on active listening in a psychotherapeutic context. We all want to be heard, even in a workplace situation, and we are much more likely to feel that we are being heard and taken seriously, and that we are with someone that we can trust, when we are being actively listened to.

**Objective:** In this lab you will look at a video that explores what active listening is, what it accomplishes, and how to improve your listening skills. You'll learn that active listening can go a long way in ultimately providing a satisfactory outcome for your customer, others in your organization, and you, yourself.

Then, you will have an opportunity to role play and try a more realistic scenario that you might encounter in the workplace. One of those in your group will draw on an actual situation that happened in the workplace arena and members of your group will have an opportunity to use or not use active listening and see how this affects your communication.

**Equipment:** No special equipment is needed other than a computer, tablet, or smartphone to view the video.

## **Procedure for Activity #1:**

Your class should be divided into groups of 4 students or as your instructor deems appropriate.

Watch the TED talk (2015) by William Uri (15 min.)

Procedure for Activity #1: Simply watch this TED talk.

### Movie 3.7 TED talk (2015) by William Uri



Tap to view a video

1. Uri talks about three reasons that active listening helps with. Describe briefly something you experienced, where your active listening helped you with one of these three (or where it would have helped, had you actively listened.)
2. Why does Uri believe that active listening, while sounding easy to do, requires learning and practice? Describe briefly a thought or two that may have occurred to you as you listened to Uri that interfered with your ability to actively listen to him as you watched this video.
3. Describe two new things you learned about the value of active listening from the two negotiation stories that Uri told.

#### **Analysis:**

1. Uri explicitly gives three important reasons for active listening. His perspective comes from being an experienced negotiator in which his goal is to bring two sides together to resolve differences that are acceptable to both sides. In your role as an SCT, you also want to resolve problems, either between two other parties as a customer and a vendor (e.g. when can a part get here for my team to repair?) or simply to resolve a problem between your direct supervisor and yourself. A key point is that to understand the other side (or the two sides) you need to carefully listen in order to understand the problem from another's point of view. This may entail not only the words spoken, but how they are spoken, and what may not be directly said but implied in the other's behavior or emotion as he or she is speaking to you.
2. As Uri explains in the video, it is difficult to absorb what is being said to us when we are immediately reacting (e.g. feeling that we need to defend our position,) evaluating (e.g. what we hear is just not true,) or how we think a situation should be dealt with (e.g. the speaker should just realize that in life things don't always go perfectly.) When doing this we cannot put ourselves in the position of the speaker and empathize with the speaker's position or fully understand how he or she understands the situation. We may miss reading between the lines about what is in fact a more fundamental issue that needs to be addressed.

You will each have had your own experience with not fully listening to another. See if you can identify your own tendency in situations to miss the opportunity to actively listen to another. Notice that at the end of the video Uri suggests that by listening to ourselves before going into a dialogue with another we can mitigate the impediments to active listening.

3. Your answers will vary but there is much here to take in and learn from when attempting to be a better listener.

**Procedure for Activity #2:** Role playing a more realistic scenario with and without using active listening techniques.

One of you will take the role of having a business problem that you want corrected. Choose a problem that actually happened to you in the past. Here are some examples to look at when thinking about the situation that you choose for this activity. Perhaps an order didn't get to you when promised, or a contractor promised you he'd install quality windows, and within a month, half of the windows stick and are very difficult to open and close. Or imagine that your new cellular service doesn't work from your house and you need to go outside of it to get a signal, or that your doctor's office says you need to wait 3 months for an appointment for a problem that you feel cannot wait that long. Again, these are just examples but choose something from your own life that's happened.

You will present this problem to someone else in your group. In this first go-around, another in the group plays the role of the responder to your problem. He or she should try to resolve your problem, but without trying to use the active listening techniques you've been learning about in this chapter. See how the scenario plays out. When over, you should explain to the group how you felt during the interaction and if you felt it was an effective interchange. The two sitting out this round should observe and offer their evaluation of the effectiveness of the interchange and should offer suggestions for an improved outcome.

Now you replay the scenario with one of those who sat out the first time. But this time the new responder that is chosen should attempt to use active listening, while working toward resolving the problem for you. When done again, describe for the group how you felt during the interaction and if you felt that things were effective this time. Again, those who sat out this scenario should observe and give their independent assessment of the interchange, and also suggest how active listening might be even further improved for an even better outcome.

### **Analysis:**

Summarize, in writing, what the role-play situation was, and how the presence or absence of active listening affected the success of the interaction. Each group will have a different role-play situation and so experiences will vary. There are times when you may have very little to offer in the way of action and yet, even



here, the active listening and empathy you can show a customer can make the difference between the situation being intolerable on the one hand and being regrettable but something that can be lived with on the other. At other times it may allow for formulating a resolution where two opposing sides can each walk away satisfied, as you saw in the Uri video of Activity #1.

The student presenting the problem should expect to feel the interchange was more successful when actively listened to when the active listening is done reasonably well. Observers should be of help pointing out where active listening can be done more effectively.

Focusing and practicing active listening should strengthen this skill but you should also appreciate that you will need to continually practice this skill when communicating to become proficient. Remember how Uri remarked how he could come home from a negotiating session where he felt that he had done a very good job in actively listening and then return home to his wife and children and fail to meet that same high standard. Active listening requires constant vigilance and it is easy to lose focus and fall short of the mark.

### **References:**

This is a link to a very brief video with Carl Rogers (1974), founder of Client-Centered Therapy, and how he came to see the importance of simply listening to his patient.

This is a more extended video on Carl Rogers's (1974), ideas about active listening and the paramount role that empathy plays. He explains how he developed his ideas, and formulates a precise notion of what empathy is, along with an example of using it.

The video was an address to psychotherapists or those interested in psychotherapy. So here the active listening is completely in the

### **Movie 3.8** Carl Rogers excerpt (1974)



Tap to view a video

service of the client who is in therapy. However, even in the workplace where each of us has his or her own goals to achieve, active listening and empathy gets us much closer to understanding the one speaking to us, builds trust, and enhances our ability to find and address the true concerns of the speaker, so that, as Uri says in the Activity #1 video, we can “get to yes.”



### Movie 3.9 Carl Rogers extended (1974)



Tap to view a video

Harry Weger Jr., Gina Castle Bell, Elizabeth M. Minei & Melissa C. Robinson (2014). The relative effectiveness of active listening in initial interactions, *International Journal of Listening*, 28:1, 13-31, [DOI: 10.1080/10904018.2013.813234](https://doi.org/10.1080/10904018.2013.813234).

This paper, available online through the link above, gives an overview of active listening in the literature along with experimental results. It studies active learning by comparing it with other modes of interacting with a speaker such as simple acknowledgement of what the speaker is saying or of providing advice. Active listening comes out favorably and, on several criteria, it is superior to other modes.

# Workplace Communications Body Language Lab Exercise

**Introduction:** In today's lab you will explore how body language can impair or enhance your ability to communicate effectively with those around you as a SCT (Supply Chain Technician,) whether they are customers or vendors outside of your organization, or internally with those in your department or outside of it including those who direct you or those whom you may direct. Body language is an important form of nonverbal communication that often carries as much or even more weight than the words we use in communicating with others. As such, body language plays a very important role not only in your workplace but in your life outside of work as well.

**Objective:**

Three activities are set out for you in this lab.

The first activity of the lab is exploring how receiving mixed messages of any type can impair the brain's ability to process information and so becomes a barrier. You will look at what happens when language is saying one thing but the way it is presented suggests another. There is a classic test in psychology called the Stroop Test that illustrates the principal

well. You will be asked to take this test and draw your conclusions from the experience.

The second activity is to watch a video (TED talk) about body language and its capacity for effecting how communications are interpreted by others but also, perhaps surprisingly, how it effects the speaker himself or herself. You will be asked to reflect on the video and how it informs you about the importance of body language.

The final activity is a role-play. You will be given a scenario that might come up in the workplace and be asked to practice good and bad body language and to assess areas of strength and weakness that you observe.

**Equipment:** Activity # 1 requires a watch with a second hand. The stopwatch on a smart phone is even better. Otherwise, no special equipment is needed other than a computer, tablet, or smartphone to view the video for Activity #2.

**Procedures:**

Your class should be divided into groups of 4 students or as instructor deems appropriate. Note that three activities are presented. Your instructor may choose which to include depending on the time available and the focus of your class.

**Procedure for Activity #1:** Perform the Stroop test.

Measure to the nearest second or better the time it takes to read aloud the actual colors of each word on the list in Figure 1 below.

Figure 1

|       |       |       |       |
|-------|-------|-------|-------|
| RED   | BLACK | GREEN | GREEN |
| BLACK | BLUE  | RED   | GREEN |
| BLUE  | BLACK | GREEN | BLUE  |
| BLUE  | BLUE  | BLACK | RED   |
| BLACK | GREEN | RED   | RED   |

Each member should read the list once and record the data of another once. The list can be read a column at a time and move to the right on the page, or a row at time and move down the page. The one keeping time should also count the number of errors made in reading the list such as saying “blue” when what appears on the list is blue. (You should say “red” since the color is red.)

Now do the same thing for Figure 2 below. Remember, read the name of the color and not the word, so blue should be read as “red” since it has a red color.

Figure 2

|       |       |       |       |
|-------|-------|-------|-------|
| RED   | BLACK | GREEN | GREEN |
| BLACK | BLUE  | RED   | GREEN |
| BLUE  | BLACK | GREEN | BLUE  |
| BLUE  | BLUE  | BLACK | RED   |
| BLACK | GREEN | RED   | RED   |

You should now have four measurements for each student in the group – time and error number for the first table and time and error number for the second table.

Alternative procedure for Activity #1:

[Here you can find two tables and a built-in stop-watch for taking time measurements.](#) The color differentiation might appear clearer on the website.

**Analysis:**

1. Look at the data and see if there is a consistent difference between the time each student takes between the tables. Also see if there is a difference in error number between the two tables. Record your results by making a table for each student in your group with the columns for the four measurements you have on each student and look for a pattern.
2. What do you think the principal difference is between Tables 13.1 and 13.2?
3. Conjecture why you find any time differential or error number differential between the two tables.

### **Interpretation:**

You should find that it is noticeably longer to read through Table 13.2 than Table 13.1. and that the number of errors increases. The principal difference is that in 13.1 there is a congruence between the written word and the color of the word (that is, the word “red” is written using red font and so on.)

You see that when you receive conflicting information in table 13.2 with the words out of sync with the color of the word the brain has a more difficult time. It needs to reject the written word in place of the actual color of the lettering. (In fact, this test is also used as a measure of impulse control to see if an individual can suppress the urge to utter the lettered word instead of its color.)

Now in this simple test you know that you are supposed to favor the color over the lettered word so that it is possible answer the question correctly even though it may take a little longer to do so when there is a conflict. In the case of oral communication when you are talking with someone and exhibiting conflicting body language it is even more difficult to discern which mode is more reliable. Many will choose to rely more on the body language. One reason is that it is more difficult to control and secondly it is a more basic mode of communication extending across non-human species (as you will see in the next activity.) This said, you can appreciate the importance of having your body language consistent with the message you are attempting to deliver.

**Procedure for Activity #2:** Watch and reflect on the TED talk by Amy Cuddy.

Please notice that it is the fifth video that comes up on the page, so don't click on the first video that you see.

Simply watch the TED talk.

### Movie 3.10 TED talk by Amy Cuddy



Tap to view a video

#### Analysis:

1. Explain how the author explains why a particular type of body language is interpreted as it is. (Why, for example are upraised hands connected with the idea that an individual is powerful?) In this sense then is body language more a sign or a symbol? For example, a green light is used as a symbol. Green light is assigned a meaning of “you are permitted to cross through the intersection. A skull and cross bones on a bottle to indicate poison is used as a sign in that the form of the representation sheds light on its meaning, e.g. if you drink this bottle you may not live much longer. Compare this with verbal language.

2. Based on the video, what evidence is there that body language is deeply rooted within people and so has great significance for the receiver of a communication?
3. Are you surprised that body language can have an effect on the person who displays it? How might you use this to improve your communications in the work place?
4. Discuss the change in Amy Cuddy’s body language during the video as she nears the end of her talk. Do you think that in the video her body language is in accord with her verbal message?

#### Interpretation:

1. You should recognize that body language is more a sign than a symbol. For example, holding arms around oneself is a protective action either to ward off blows or to avoiding being in someone else’s space that could lead to antagonizing that other person.
2. The video shows that body language is a language of communication found in other primates, mammals and other classes as well such as birds. As such, body language is deeply biologically rooted.
3. The fact that the body position can affect one’s own mood, hormonal level, and sense of self will probably be a new idea to many of you. Being aware of this could be useful in learning



better communications with others in the workplace and elsewhere.

4. Dr. Cuddy is visibly moved towards the end of her talk as she describes a bad accident and how it affected her sense of self as an older teenager. When at her lowest she describes how an advisor helps her to “fake it until you make it,” that is, my displaying body language displaying confidence and authority she was able to be more confident and successful in a presentation and, eventually, in life. The body language in her talk conveys authenticity and sincerity along with confidence and authority.

**Procedure for Activity #3:** Role-play, practicing congruent and incongruent body language

Read the role-play scenario below:

“Your sales department manager comes down to the floor to find out why a good customer’s order has been delayed for over a week. She goes on to say that she had given a firm commitment that the order to be at the customer’s a week ago and the customer is extremely angry and threatening to pull his business. The reason for the delay is that a machine is down and the part you had been promised in order to fix the machine that was to be there over two weeks ago should be there by tomorrow so the customer’s order should be able to be assembled and shipped to him in the next four days. The sales manager is angry herself and

you need to explain to her what has happened and when you expect to have the customer’s order to him.”

Play out the scenario twice, the first with 2 members of the group where each engages in incongruous body language. The other two who sit out should comment on their perceptions of how things went in this version of the role-play. Also, these two should comment on how to improve the interchange.

The scenario is repeated, and the two who sat out the first time now role-play using congruous body language. Afterwards, those who sat out should comment on how successful this replay went. Also, they should comment on how the body language might be improved to have an even more successful productive interchange.

**Analysis:** After the two role-plays and comments from your group, each of you should answer the following questions:

#1 List three things you learned from the role-playing exercise.

#2 List three things you learned about your own body language from the comments of the other members of the group.

**Interpretation:** Your role-playing and your success will vary. The expectation is that this activity will give you an opportunity to focus on your own body language and that of your communication partner in real time and also that you will begin to think about how to improve your own body language.

## References:

[Cuddy, Amy J.C., Caroline A. Wilmuth, and Dana R. Carney \(2012\). "The benefit of power posing before a high-stakes social .valuation." Harvard Business School Working Paper, No. 13-027, September 2012.](#)

The effect of body language: This paper coauthored by Amy Cuddy, the TED Talk speaker, focuses on how striking a “power pose” even before an actual verbal interchange can improve the quality of that interchange and lead to a more successful outcome. It does speak to the importance of body-language in interpersonal communications.

[Kaps, R. W. and Voges, J. K. \(2007\). Nonverbal communications: A commentary on body language in the aviation teaching environment](#)

Overview of the importance of non-verbal communication: This article is written by Kaps and Voges, individuals with backgrounds in aviation and in teaching, so there is a focus on these two areas and the importance of non-verbal communications in these arenas. But they make clear that this is generalizable to all interpersonal communications. The paper can serve as a good introduction to the importance of non-verbal communication.

[Stroop Effect: This is Stroop's original 1935 paper.](#)

# Workplace Communications Telephone Communication Lab Exercise

**Introduction:** In this lab you will learn about communicating on the telephone in the traditional way – speaking and listening. As with Active Listening in the previous lab, this may sound deceptively simple. Most older adults who grew up before the introduction of smart phones which has become so prevalent, would speak on the phone as the primary mode of communication other than direct, face-to-face communication. Those of you who are younger are actually doing less in the way of this type of communication and spending much more time texting and using social media. In fact, this alternative communication has become so common among younger people that concern has been expressed in popular and academic circles of declines in the ability of younger persons to engage in face-to-face and in traditional telephone conversation (Barnwell 2014 and Uhls et al. 2014.) In the work place, however, telephonic communication plays a very major role with texting and social media receding in importance. But even those who are very familiar with talking on the phone can benefit from examining key differences between phone and face-to-face conversation and learning how to make effective adaptations to improve phone conversation. To draw an analogy, we've all

eaten our entire lives, but that doesn't mean we all know how to eat in the healthiest way or how to prepare the best-tasting food.

The key difference between face-to-face vs. telephonic communications is that there is only an aural channel for communicating, while the visual channel is cut out. You've learned in early material from our text and from previous labs about the importance of body language in clarifying the meaning of messages being sent in a dialogue. Without the visual, there is room for not fully appreciating what the other is trying to convey. The one you are speaking with may not be able to appreciate your level of engagement, understanding, and sincerity, even when you are highly engaged and wishing to do the utmost for the one you're speaking with. The new skill needed here is enhancing your speech to compensate as much as possible for the loss of the visual.

## **Objective:**

In the first activity in this lab you will examine how your body language, *even when it cannot be observed visually*, can help your counterpart interpret the words that you use. In the second

activity, you will read through some basic practical tips to use in telephone conversation that you will be able to use in Activity #3. You will also view a TED talk about steps to consider in speaking and you will be asked to apply these steps in telephone conversation. In the final activity you will get a chance to practice what you've learned by engaging in a simulated telephone conversation. You will also repeat the conversation in a face-to-face mode and then examine the differences between modes.

**Equipment:** No special equipment is needed other than a computer, tablet, or smartphone to view the NPR radio transcript for Activity #1 and the TED talk for Activity #2.

**Procedures:**

Your class should be divided into groups of 4 students or as your instructor deems appropriate. Note that three activities are presented. Your instructor may choose which to include depending on the time available and the focus of your class.

**Procedure for Activity #1:** [Read the NPR Radio transcript from NPR Weekend Edition with Scott Simon \(2008.\)](#)

It is the transcript of an interview of researcher Amy Drahota, at the University of Portsmouth, UK. She studied the question of whether we can “hear a smile”, that is, pick up from voice alone whether the subject is smiling (and even genuinely smiling – a so

called Duchenne smile as opposed to a forced or suppressed smile.)

Read the transcript. Then do a simplified version of the study as follows. Each of the four of you will have a different role, so person #1 is chosen first and then he or she will give the others their individualized instructions and will manage this activity for the group.

*Instructions to be read by Person # 1 only:*

You will be the reader of a list of questions below. You will read them to Person # 2 and will sit facing him or her, so you can see facial expressions clearly. Read the questions so all can hear.

Each time you read a question, Person #2 should respond using the same words:

*“I’ll do it in the summer.”*

Each time person #2 responds, you should classify the facial expression as either smile, embarrassed look, or other (three categories.) If like, you can subdivide smile into Duchenne smile (meaning a genuine smile,) forced smile (as when the photographer says “smile,” but you don’t have anything to smile about,) or suppressed smile (as when you are at a funeral and something strikes you as funny, but discretion requires you not to be smiling then.) If you subdivide there will be five categories all together. Persons #3 and #4 should be sitting behind Person #2

so that they cannot see the facial expression at all. They should each independently write down after each response (keep track of the question number each time,) if it sounds as if Person #2 is smiling, embarrassed, or other. They can try to distinguish between Duchenne smile, forced smile, and suppressed smile.) So as Person # 1 you should arrange for the others in your group to fulfill their roles. The idea will be to see how much your visual rating of the facial expression matches the perception based on hearing the voice only.

Here are the questions to be read slowly and in the order they are written, Take time to rate the facial expression of Person # 2 before going to the next question:

1. Will you eat ice cream?
2. Will you sunbathe?
3. Will you picnic?
4. Will you skinny-dip?
5. Will you go to Mars?
6. Will you tell people that you wish you were on Mars now instead of answering these questions?
7. Will you see your boyfriend?
8. Will you see your girlfriend?

9. Will you tell people how absolutely horrid and ridiculous these questions are?
10. Will you rob banks?
11. Will you cheat on your taxes?
12. Will you cheat on your boyfriend or girlfriend?
13. Will you go on an Alaskan cruise?
14. Will you do a very disgusting thing that you couldn't tell anyone?
15. Will you be telling people to avoid this lab at all costs?

**Analysis:**

1. Using the 3 categories of smile, embarrassments, and other, count the average number of correct responses using both aural raters' answers. A perfect score would be 15, meaning that for each question, both raters matched the visual facial expression as determined by Person #1. Report your findings and discuss the validity of the assertion that smiles can be heard based on your results. Remember that someone randomly guessing answers without hearing anything might have a 1/3 chance of getting each response right. Summarize your results in writing.



2. This is a simplified study, but assuming the authors conclusion is justified, namely that we can hear, in some sense, the visual facial expressions that we display in conversation, what are the implications for you when conducting conversations over the phone in the work place? Summarize your results in writing.

### **Interpretation:**

1. This is a simplified study in that we have only two observers who are rating facial expression based on listening alone. Also, perhaps more importantly, these raters are hearing the questions in addition to Person #2's response of "I'll do it in the summer." So, it could be argued that the raters may be relying on their perception of an appropriate response rather than relying on Person #2. However, some questions are more difficult to interpret as a funny question, embarrassing question, or neither of these. For example, the responders' sex and personal circumstances will have an influence on how the responder will be struck by questions #7 and #8.

Although imperfect, this student-performed study should be expected to support the author's conclusion. Student groups can be expected to get varying degrees of support for the author's hypothesis depending on how expressive the responder is and on how nuanced raters may be in their aural perception.

2. The author sees implication for construction of synthetic speech. If you've ever called United Air Lines and heard the synthetic voice on the other end, you will hear one that is much superior to other synthetic voices used by many other companies' customer service synthetic responses. The implication for conducting telephone conversation is to attempt to speak with full facial expressions so that the voice is better interpreted by the listener. If you would smile in a face-to-face situation, then attempt to do the same over the phone. Movement of the hands and general body language should be useful as well. Part of the theory is that the facial expression will affect the tone and other subtleties of the voice. There is a body of results (see summary article in Scientific American, Winner, 2009) that shows that body language can actually affect how you feel (and not just the other way around) so that when you smile you actually begin to feel more positively, and then this becomes conveyed to your listener. Hence in the 7 tips you'll read about in the next activity you'll find suggestions of getting up and moving around to improve the quality of your phone conversation.

### **Procedure for Activity #2:**

Read a short article by Pascal van Opzeeland on seven practical phone tips and then view the TED talk by Matt Abrahams, communications professor at Stanford University's business school. The article and the talk can both be found at:

<https://www.userlike.com/en/blog/customer-service-phone-tips>

Please note that the seven tips will be helpful when you work on Activity #3 and are asked to simulate an effective telephone conversation in the workplace.

Read the seven tips by Opzeeland and watch the TED talk.

### **Analysis:**

1. Abrahams speaks about 4 steps to consider when speaking with someone else. Analyze how Abrahams, himself, uses these 4 steps in the construction and delivery of his TED talk. Summarize your results in writing.
2. Keeping in mind the telephonic focus of this lab, write about how each of the 4 steps that Abrahams mentions might apply to a telephone conversation that might occur in the workplace, with either a customer, your boss, or someone from another department in your organization. Write about one item from each of the four components of his talk.

### **Interpretation:**

1. Abrahams's talk gives four elements to keep in mind in any conversation. Applying these to his talk should help you solidify your understanding of these points. Although this is a public lecture, notice the approach he takes, and how his

consideration of the audience helps to shape his talk. How does he use context in the construction and delivery of the talk? In particular, how does he communicate his emotion and instill an emotion to his audience, in addition to information. How well do you think he does this? There is a clear structure he uses in his own talk and you can see which of the ones he mentions is followed here by his own talk. Does he employ a different structure?

2. Now apply these elements when using the telephone in conversation. Your answer here may vary quite a bit. Remember that the key difference is the lack of visual cues. Studies have also shown that there may be different expectations of what will result from a telephone conversation vs. a face-to-face one (Hewitt et al., 2010) and so, for example, there may often may not be as broad a range of territory covered in the telephone call vs. a face-to-face meeting. So, extra-effort and ingenuity may be required to use your voice alone for your connection, care, and interest in resolving any issues between you and your counterpart. You also need to work harder to glean from your counterpart what you can from the voice alone.

In addition to the seven practical telephone tips attached to this link there is another much more extensive manual that can be found at:

<http://www.trainersnotes.com/images/pdfsample.pdf>

To augment concrete suggestions on good telephone conversation practices. If possible, it would be a good idea to look through this before doing Activity # 3 in preparation for your simulated telephone conversation.

**Procedure for Activity #3:** Role-play a simulated phone conversation and contrast it with a face-face- encounter.

One of you will take the role of having a business problem that you want corrected. You may recall this from activity #3 in the Lab on active listening. If you did this in that lab, then another of you should do it this time. Choose a problem that actually happened to you in the past. Here are some examples to look at when thinking about the situation that you choose for this activity. Perhaps an order didn't get to you when promised, or a contractor promised you he'd install quality windows, and within a month, half of the windows stick and are very difficult to open and close. Or imagine that your new cellular service doesn't work from your house and you need to go outside of it to get a signal, or that your doctor's office says you need to wait 3 months for an appointment for a problem that you feel cannot wait that long. Again, these are just examples, but choose something from your own life that's happened.

You (the "complainer") will present your problem in a phone call to someone at this business. So, choose another person (the "resolver") in the group who will attempt to resolve this issue. To simulate a phone call situation both of you should be facing back-

to back so that neither sees the other. If either of you wishes to stand or move you may do so, just make sure that neither person looks at the other. The two who are sitting out should listen carefully to what is said and how it is said. They should also observe the body language and facial expressions of the two speakers – something that the two speakers are unable to do themselves. The resolver should use the tips from activity #2 and the video along with what you've learned from the material in this and previous parts of our texts and previous labs to resolve the problem. As mentioned at the end of Activity #2, there is another much more extensive manual that can be found at:

<http://www.trainersnotes.com/images/pdfsample.pdf>

to augment concrete suggestions on good telephone conversation practices. If possible, it would be a good idea to look through this before doing Activity # 3 in preparation for your simulated telephone conversation.

When the activity is over, the resolver should talk with the group about the specific telephone techniques she employed to help in the resolution of the problem. The "complainer" should discuss how he felt during the conversation and whether he felt his problem was resolved. The observers should give their assessments of how successful the resolution went. They might also offer constructive comments on what additionally might be done to make up for the fact that visual cues were missing in this simulated telephone situation.

Repeat the exercise with the same complainer and a different resolver. This time the encounter should be face-to-face. The resolver should do her best using what has been learned in this chapter. When over, as before, the “complainer” should discuss how he felt during the conversation and whether he felt his problem was resolved. The resolver should discuss the advantages (and possibly any disadvantages) in the face-to-face vs. telephone conversation. The observers should give their assessments of the success of this resolution attempt. All should talk about the differences between the two encounters and how best to overcome the lack of visual cues in the telephone situation.

Each of you should write a summary describing the problem, and what happened in each resolution attempt. You should describe the overall differences in the success of the face-to-face vs. the telephone encounter. Also discuss techniques employed in the telephone encounter and how successful these were in leading to a successful resolution. Finally, talk about any additional techniques that could be employed in the telephone situation for a more successful outcome.

Summarize, in writing, what the role-play situation was, and how the presence or absence of appropriate telephone behavior affected the success of the interaction.

### **Analysis:**

Each group will have a different role-play situation, so experiences will vary. As in the Active Listening role-play of the previous lab, even when there may be little to offer in the way of action, listening and empathy can make a difference between a situation being intolerable or one that can be lived through. At other times a good conversation may lead to a successful resolution where both sides can walk away satisfied.

Generally, the face-to-face replay of the role-play should feel more successful than the initial telephone conversation. To exaggerate the point, if there is a conversation with a clear telephone connection, things ought to go much more smoothly than with a very poor connection where many words are garbled or are cut out altogether. Each side has less information and attempts to fill in the information in his or her own way which may or may not be accurate. In the same way, in a telephone conversation we will all tend to fill in the lack of visual with our best guess of what might be there, but we may not always be successful, leaving a poorer outcome with a telephone call. Therefore, it is incumbent on you as one party to the conversation to do your utmost to convey your meaning through your voice, timbre, intonation, rhythm, and pitch to help the other side. As we’ve seen in Activity #1, the use of genuine facial expressions and other body behavior, will help convey your meaning even though your counterpart cannot see them. It is also incumbent on you to discern as best you can the meaning that you can extract from your counterpart and to request clarification when you aren’t

certain. For example, in a face-to-face situation when you propose a resolution, a big smile on your counterpart's face will tell you that your resolution is highly acceptable. Over the telephone you might ask, "How does this sound to you – I believe it should meet the requirements that are important to you?"

### **References:**

Barnwell, P. (2014). My students don't know how to have a conversation, The Atlantic, Apr. 22, 2014.

<https://www.theatlantic.com/education/archive/2014/04/my-students-dont-know-how-to-have-a-conversation/360993/>

This article in the popular press discusses decline in conversational ability with increased use of texting and use of social media.

Drahota, A., Costall, A., & Reddy, V. (2008). The vocal communication of different kinds of smile. *Speech Communication*, 50(4), 278-287. DOI: 10.1016/j.specom.2007.10.001.

This is the citation to the Drahota article along with a link to the abstract.

Hewitt et. al (2010). Comparison of face-to-face and telephone consultations in primary care: qualitative analysis, *Br J Gen Pract*. 2010 May 1; 60(574): e201–e212.

This is a journal article from *British Journal of General Practice* (BJGP - a medical journal) regarding interaction between physician and patient in face-to-face vs telephone situations. It was found that telephone elicits less than face-to-face with focus on one issue vs. multiple issues. The authors see promise for more telephone consultation at length, recommending the need for more "verbal examination" (in other words try to ask the patient over the phone in more detail what is going on and not just rely on the patient's description of the problem – just as in the examination room.) This is an example of academic work exploring empirical differences between these two modes of communication.

Holbrook, A., Green, M. and Krosnick, J.A. (2003). Telephone versus face-to-face interviewing of national probability samples with long questionnaires comparisons of respondent satisficing and social desirability response bias, *Public Opinion Quarterly* Vol. 67:79–125, 2003.

This is a second example of empirical research on the efficacy of telephone vs. face-to-face modes in conducting election polling.

Simon, S. (2008).

<https://www.npr.org/templates/story/story.php?storyId=18255131?storyId=18255131>

This is a transcript from NPR Weekend Edition with Scott Simon (2008) interviewing researcher Amy Drahota, at the University of



Portsmouth, UK, who studied a person's ability to "hear a smile", that is, pick up from voice alone whether the subject is smiling (and even genuinely smiling – a so-called Duchenne smile.)

<http://www.trainersnotes.com/images/pdfsample.pdf>

This is a manual from trainersnotes.com on using the phone with good basic information laid out in the first 23 pages. This is a good overall reference for you to read to help you develop your telephone communication skills.

Uhls, U.T. et al. (2014). Five days at outdoor education camp without screens improves preteen skills with nonverbal emotion cues, Computers in Human Behavior, Vol.39 pp. 387-392.

<https://www.sciencedirect.com/science/article/pii/S0747563214003227#>

This academic paper comparing children at a summer camp to a control group, also studies decline in conversational ability and the ability to read social cues as a consequence of increased reliance on technology for communication.

Wenner, M. (2009). Smile! it could make you happier, Scientific American, Sept. 2009.

<https://www.scientificamerican.com/article/smile-it-could-make-you-happier/>

This is link to a magazine article in Scientific American by Melinda Wenner about facial expressions affecting one's emotions.

# Workplace Communications Written Communication and E-mail Lab Exercise

## Introduction:

In this lab you will learn about written communications in the workplace including business email writing. You've been learning how to write beginning with elementary school and continuing with high school. You will continue this in your college classes as well. This lab cannot hope nor is it intended to replace all your study to this point. The focus here, however, is on your writing in the workplace. It's likely that you have not encountered workplace writing much if at all in your schooling up to this point. Many years ago, I recall my elementary school teacher spending time on writing a "friendly letter" and a "business letter" with the focus of the placement of heading, salutation, closing, etc. That was about it – the form of the letter, but not about writing an effective one that will have its intended result on the recipient.

We might first pause a moment to consider the difference between written and oral communication. Speaking and listening comes quite naturally to us. Humans have been around speaking for well over 50,000 years (estimates going back to 200,000 years) - before formal schools and before written

language. It is much more natural to us. Written language appears to have developed for commerce to allow for keeping track of inventory, of who owes what to whom, and other similar types of information (Spar, 2004.) It was a way to record information in a more permanent and precise way and could be looked at repeatedly, without the need to rely on individual's memory or accuracy. This is why contracts today are typically written and are much preferred to oral contracts. So, writing was developed for practical reasons and not for the purpose of composing great literature. In fact, we know that Homer's *Iliad* and *Odyssey*, probably written in the eighth century, existed as oral poetry for hundreds of years before they were reduced to written form (Cartwright, 2017.)

The origin of the written word suggests the importance of writing in a clear and practical way when communicating with others. We are in business to take care of business in the most efficient way to achieve practical ends. When we are unclear, recipients may not know what is asked of them, *even if* their inclination might be to help us. Whatever the goal, we want others to have a clear understanding of what is being asked and to be

persuaded *through our words* to comply. The use of unclear language, including the use of big words or jargon that is not likely to be understood should be avoided. So, for example, don't use the word "sesquipedalian" (a big word for a big word) unless you're speaking to a group of authors or to your English department's faculty.

A second important point about writing in business is that it should be written succinctly. A remark in a letter written by Blaise Pascal in 1657 that has been repeated in some form and attributed to many others is:

*"Je n'ai fait celle-ci plus longue que parce que je n'ai pas eu le loisir de la faire plus courte."*

which can be translated roughly as "I only made this letter as long as it is because I didn't have the time to make it shorter." He is implying that although the writing appears shorter on the page, it actually requires much thought to distill the essence of the communication, cutting out the unnecessary, the distracting, and the obscuring. This takes thought on the part of the writer. It is a key reason why writing is emphasized so much in school. Clear writing forces us to think things through and the output of this is good writing.

A third important point about writing is that it tends to be one way. I write and you read. Of course, you can write back, but it can take time. With a written letter this could be a week or more

(hence the term "snail mail." Even with email you must wait for the recipient to read your email and then write a response. If you need to go back-and-forth several times it may not be the most efficient way of getting to any conclusion; writing may not be the best choice here and a face-to-face or telephone conversation may be much better in that case. So, writing is best when a more permanent record is needed, or when precision is needed, and a lot of back and forth between the two parties is not required. Also, as you have already learned, without body language or the human voice (with its pitch, inflection, cadence etc.), many of the tools you can use in face-to-face or telephone conversations are taken away in written communication. This makes it more difficult to convey what you want to communicate and to discern what your partner wishes to communicate. There is the potential for meanings to be lost. This needs to be considered as you write and read, since meaning can be conveyed *only through the words on the page*.

### **E-mail Writing:**

The virtue of the email over other forms of written communication is the speed and ease with which information can be sent. This has led to it being a primary mode if not the primary mode of communication in the workplace. One estimate is that for many, writing and replying to emails can consume over a quarter of one's workday (McKinsey Global Institute analysis, 2012.)

Because of the ease of writing, it's understandable that many approach email writing in a more casual way than other types of writing. On the other hand, from the receiver's point of view, with tens to possibly more than a hundred emails in the inbox, it becomes a daunting task to get through them and give each one its proper due, making sure that the most important and those requiring the most immediate action are given priority.

These characteristics have implication for writing good emails in the workplace and also for responding to them with the goal of increasing clear communication, efficiency, and getting the result you desire by your email or your reply. The implication for the writer is to keep emails succinct and make it easy for the receiver to understand the communication and what the sender is requiring of him or her. Unnecessary socialization, or requests embedded in a sea of words that the receiver needs to pluck out, tax the receiver who has all those other emails to get to. The reader may get confused about what is required and pluck out the wrong item or misinterpret the response that is asked for. This results in wasted time for the reader, and failure to get the desired outcome by the sender. We will specifically look at some good practical tips for writing and reading though emails and you will have an opportunity to practice writing effective emails in the workplace.

### **Objective:**

Here's an overview of activities for this lab:

In Activity # 1 you will listen to a short video on writing clearly and understandably in workplace settings. You will then have an opportunity to rewrite a very famous document from American history using what you have learned in the video.

In Activity #2 you will have an opportunity to write a repair order using your text's guidance in preparing it. One of you will be the "complainer" who needs something repaired, and another of you will play the role of the SCT who will write things up giving your diagnosis of the situation (the "cause" in your text) and how you fixed the problem (the "remedy," in your text.)

In Activity # 3 you'll look at a talk about practical tips for writing good business emails and then have an opportunity to rewrite an email using the tips that you learned about, remembering to use clear and simple language as you do your rewrite, and to help the reader understand exactly what is asked of him or her.

### **Equipment:**

No special equipment is needed other than a computer, tablet, or smartphone to view the videos for Activity #1 and Activity #3.

### **Procedures:**

Your class should be divided into groups of 4 students or as your instructor deems appropriate. Note that three activities are presented. Your instructor may choose which to include, depending on the time available and the focus of your class.

**Procedures for Activity #1:** Read the Harvard Business Review article by Josh Bernoff and listen to the TED talk by Alan Siegel about the need for clear and simplified language in written communication.

The article, titled [\*\*Bad Writing Is Destroying Your Company's Productivity\*\*](#) (2016,) is about the importance of clear writing in the work place with examples of good and bad business writing. The TED talk, titled [\*\*Let's Simplify Legal Jargon\*\*](#), explains how writing clearly, simply and transparently can improve written communications and have an important effect on the reader.

Read the article and listen to the talk. After commenting on these (see directly below) you should read the opening passages of the *Declaration of Independence* reprinted below, which you will be rewriting based upon what you've learned in the article and the talk.

### **Analysis:**

Write briefly the most important point you took from the article and then write the most important point you took from the talk.

After this, read through the opening passages of the *Declaration of Independence* that was written by Thomas Jefferson and is reprinted below. The statement was a declaration to the world, and so would justify a formal, elaborate, perhaps poetic style of writing. It is certainly one of the most masterful and memorable

pieces of writing in the English language. But now suspend your associations and reverence for the document and reimagine it anew, as if this were a business memo explaining the need for separation. How might you rewrite this, keeping in mind brevity, clarity, transparency and persuasiveness? Microsoft makes one edit – replacing “in the Course of” with “during” along with a few changes in punctuation and replacing the word “effect” with “affect.” See if you can improve on these edits.

Write your finished business version of the document. You should work together as a group on your summary to produce your version of this masterwork.

Here are the opening passages:

When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.--That to secure these rights, Governments are instituted among Men, deriving their just powers from the



consent of the governed, --That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security.--Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States.

### **Interpretation:**

Each of you will have your own reactions to the article and to the talk but you should all should see the importance of simple, clear,

transparent, and persuasive writing to get the results you hope to achieve.

The rewrite of the Declaration of Independence as a piece of business writing is purely an exercise to improve your writing skills. It should include the key points of Jefferson's argument for separation from Great Britain.

The thread of the argument is as follows. Leaving a political structure is a serious act with many consequences, so people are owed an explanation and justification, which the Declaration is. It is obvious and without any need for further justification that one person's life carries equal weight to any other person's, and that we are all entitled (by the Creator – not something given to us by a person or by society.) to our lives, our freedom, and the right to pursue our goals for a fulfilling life. Jefferson was a Deist who believed that there was a Creator. He believed that Jesus was a great moral teacher but not in his divinity. With this a backdrop, he argues the purpose of a government is fundamentally to achieve these entitlements. Therefore, when a government such as that of Great Britain acts in hindrance of these through tyrannical imposition of its power, the people are fully justified in withdrawing from this political structure and setting up one that will achieve the ends that a government should rightfully pursue. He adds that it is not enough for a small breach to justify a full-blown rejection of a government in favor of another, but when there is a consistent pattern of tyranny that interferes with basic

human rights then the separation becomes justified. The actual tyrannies of Great Britain are listed immediately following these opening passages in support of this separation.

Although your rewrite should avoid all the flowery language, which is very poetic and beautiful, it should convey the heart of the argument simply, clearly, and persuasively so the reader will understand why the separation was necessary.

**Procedures for Activity #2:** Reread your text on writing Preventative Maintenance Orders, Repair Orders, and Emergency Repair Orders, pp. 274-277. Afterwards you will practice writing your own Repair Order.

One of you in your group will document the complaint as a supervisor might (the “complainer” role.) Another of you will play the role of the SCT and fill out the balance of the form. Ideally, you can all discuss a breakdown of some piece of equipment that you are all familiar with. To take cars, as an example, a problem might be that the car’s radiator is running hot, or that the car fails to start. **The complainer should write a somewhat vague complaint**, lacking detail, on the report. The SCT will now have to fill out the balance of the report – making a diagnosis (the “cause” in your text) and documenting what repair was made (the “remedy” in your text.) To get more information from the complainer before reaching your diagnosis, **you ought to spend a few minutes talking to the complainer and obtain more**

**detail** on the complaint to help you complete the cause section of the form. Complete the cause and remedy section after this. A simulated 2-page order form for you to work with is provided on the next two pages.

### **Analysis:**

All of you should discuss how the complainer could have written a better complaint instead of the vague one that was written, now that it is understood in greater detail what the problem was. You should also discuss the diagnosis and remedy section and how the Repair Order form might be further improved. After your discussion, work together on rewriting the Repair Order form as a final product of your work together. A simulated 2-page order form for you to work with is provided on the next two pages.

Activity #3 on writing effective emails will follow these next two pages.

### **Interpretation:**

Ideally, as an SCT, the complaints you receive on work orders will help you to diagnose what the problem is. Knowing if the problem is always there or only there under certain conditions can prove very helpful in reaching your conclusion. Through questioning the complainer about the problem, you should all appreciate how the added detail will improve the accuracy of the diagnosis. The reason for choosing an item that you’re familiar

with is so that you can write down a plausible diagnosis and remedy. As an example, if the complaint is that the car doesn't start, you might learn that this happened when a dome light was left on all night and the battery discharged. A simple recharge would fix the problem. On the other hand, if recharging doesn't help and the car fails to start soon after the recharge, a bad battery may be the culprit and it may need replacement. If the battery proves to be good, it might be a bad alternator that fails to recharge the battery, and this may need to be replaced. In the remedy section you might write that you tested the battery and it failed to hold a charge. You then replaced the battery and the car started immediately. You tried it again several times during the day with no problem so that now you are confident that the problem has been corrected.

**NOTE: THE 2-PAGE WORK ORDER FORM FOLLOWS ON THE NEXT TWO PAGES.**

**REPAIR WORK ORDER:**

To file a work order please fill out all underlined and italicized information.

ABC Company  
123 Warehouse Drive  
Enid, OK 73701  
580-987-6543

INTERNAL REPAIR WORK ORDER

DEPARTMENT                      ORDER REQUESTED BY

EXTENSION                      ORDER RECEIVED BY

ORDER DATE                      EXPECTED START DATE                      EXPECTED END DATE

WORK AUTHORIZED BY

PERMISSION TO ENTER SPACE    ANYTIME                      BY APPOINTMENT                      DATE                      TIME

REQUESTED WORK DESCRIPTION (This is the complaint from your text.)

ADDITIONAL COMMENTS

WORK PERFORMED BY (To be completed by technician.)

CAUSE (To be completed by technician. This is the technician's diagnosis of the problem.)

DESCRIPTION OF WORK COMPLETED AND MATERIALS USED (To be completed by technician)

(This is the remedy from your text.)



WORK ORDER COMPILED BY  
(To be completed by technician)

COST OF LABOR     \$-

CLIENT APPROVAL NAME AND TITLE  
(To be completed by technician)

COST OF MATERIALS     \$-

APPROVING PARTY SIGNATURE

TOTAL     \$-

DATE OF APPROVAL

CHARGEABLE TO

**Procedures for Activity #3:** Look at the You Tube video by David Taylor who teaches business and technical writing at the University of Maryland University College, *Top 10 Email Hacks* (2018.)

You will then have an opportunity to rewrite an email using the information you've learned in this lab and particularly from the video. Note: There is a second You Tube video by David Hendrikz, a South African professional trainer, on the same topic. Although there is some overlap, the second video does add some new tips and I would encourage you to view it as well, perhaps before the start of the lab. Each video is about 13 minutes.

View the Taylor video. Each of you should write down two important tips that you learned from the Taylor video (and the Hendrikz video if you were able to look at that as well.) Next, read through the email below which you will be asked to rewrite. Here is the email:

Date: June 4, 2018

From: Alfred Parkinson, Repair Services

To: Michael McMillan, V.P. of Human Resources

Subject: Repair Staff

Hi Mike,

It's been a while since I've seen you and I hope you are doing well. Your boy just started at Indiana. How's that going for him?

I'm working now on a proposal and I'm hoping you can help. The idea is to consider increasing our repair staff and also increasing the efficiency of our dept since lately we seem to be behind the 8-ball more times than I can count. If you could chime in with some additional information, it would be extremely helpful as I work through this. I guess I'd like to learn how long people in our dept. stay with us on average. I'm thinking if we could lower the turnover rate, which I suspect is on the high side compared to depts. elsewhere, we could push up the average experience level of the dept and thereby increase our efficiency. Also, I'm wondering if our salary schedule is competitive for our repair staff. If not, this may explain a higher turnover rate if in fact this is the case. Also, if we're not competitive, we might not be attracting the most highly skilled people which is why it always takes longer than I think it should.

I need my proposal ready by a week from Thursday and any thoughts would be helpful.

Cheers,

Al

P.S. Do we have any extra money in the budget to use for another couple of positions? It would make a big difference. Let me know, please.

**Analysis:** Using the information in the Taylor video (and the information in the Hendrikz video if you were able to view that) and whatever else you've learned about writing in this lab, each member of your group should individually rewrite the email. After completion, each of you should read your email for your group who should give some constructive criticism. Afterwards, work together to construct the best rewrite and submit this as your final work product along with the original rewrites that each of you did prior to your discussion with the rest of the group.

Interpretation: The email can be improved on multiple fronts. Here are some deficiencies of the email to consider, that the suggestions in the Taylor and Hendrikz videos would help to improve.

Subject Line:

The subject line is extremely vague and forces the reader to open the email to have any understanding of what it's about. He cannot tell if he needs to do anything, and if so when. This email may become buried if there are an abundance of emails.

Body of the email:

Over use of socialization:

The socialization can be eliminated or at least reduced substantially.

Style of the body:

Rambling narrative makes it difficult to identify what is needed from the reader. One long paragraph needs breaking up, with a list format or with separate paragraphs for each piece of information that is needed. The explanation of why this is all needed is probably not necessary unless the sender believes that without justification the receiver will not comply fully. The P.S. hangs by itself and may not be responded to. The P.S. should be rewritten into the body of the email.

Required Action:

The narrative style makes it difficult to discern exactly what is required of the reader.

The time frame is also not clear. When must the sender receive the information to use it? This should be made clear.

Close:

Research has shown that when requesting something, the best close is “thanks” or even better “thanks in advance.” (See the Hendrikz video on this.)

Signature:

There is no contact information in the email such as email address, or telephone number, burdening the reader to locate these if needed. Internal emails often come only with a name and the information may need to be passed on to someone else. The reader may find it more appropriate to call and without the number the reader is again unnecessarily burdened. (See the Hendrikz video on this.)

### References:

[\*\*Bernoff, J. \(2016\). Bad writing is destroying your company's productivity, Harvard Business Review.\*\*](#)

The above article explains how good writing can either assist or impede a company's productivity. Bernoff compares two public releases, one by Marissa Meyer, CEO of Yahoo, and another by Tim Cook, CEO of Apple, and contrasts their writing. There are a number of areas pointed out where the author shows how good writing translates to a more productive business, and how poor writing reflects poor thinking and reduce productivity.

[\*\*Cartwright, M. \(2017\). Iliad. Ancient History Encyclopedia.\*\*](#)

This is an article about the Iliad and is found in the Ancient History Encyclopedia. It explains that the Iliad existed hundreds of years prior to it being reduced to written form by Homer – or by an unknown group of writers that have been ascribed to a man called Homer, who may not have existed.

Chui, M., Manyka, J., et al. (2012). The social economy: Unlocking value and productivity through social technologies, McKinsey Global Analysis Report.

The is the McKinsey Global Institute report and analysis on the time spent dealing with emails in the workplace.

**Movie 3.11** Hendrikz, D. How to write a business email video tutorial, YouTube Video (April 2014.)



Tap to view a video

Hendrikz is a professional trainer from South Africa who provides many basic tips on good email writing. There is some overlap with the Taylor video but there are additional tips here not found in the Taylor video. It is worth going through.

**[Mark, J. J. \(2011\). Writing. Ancient History Encyclopedia.](#)**

This article from the Ancient History Encyclopedia is also about early writing including the origins of writing. You may find this of interest. It does reemphasize the development of language for business and for clarity.

**[Spar, Ira \(2004\). “The origins of writing.” In Heilbrunn Timeline of Art History. New York: The Metropolitan Museum of Art, 2000–.](#)**

Spar is on the staff of the Metropolitan Museum of Art. His brief article traces the origins of writing. It explains how written language was developed for business purposes (trade) and that the movement from pictograms to more general symbols was in the service of increasing clarity and precision in human communications.

**Movie 3.12** Taylor, D., Top 10 email hacks, You Tube Video (Jan. 2018.)



Tap to view a video

Taylor teaches business and technical writing at the University of Maryland University College. The focus is on practical advice when constructing emails.

**[If I Had More Time, I Would Have Written a Shorter Letter](#)**

This link gives a reference to Blaise Pascal quote, “If I had more time I would have written a shorter letter.”

**[Effective Email Communication](#)**

This is from the writing center at the University of North Carolina in written format that also lists many tips. This gives you another practical reference.



# Workplace Communications Written Communication and E-mail Lab Exercise

## Introduction:

In this lab you will learn about written communications in the workplace including business email writing. You've been learning how to write beginning with elementary school and continuing with high school. You will continue this in your college classes as well. This lab cannot hope nor is it intended to replace all your study to this point. The focus here, however, is on your writing in the workplace. It's likely that you have not encountered workplace writing much if at all in your schooling up to this point. Many years ago, I recall my elementary school teacher spending time on writing a "friendly letter" and a "business letter" with the focus of the placement of heading, salutation, closing, etc. That was about it – the form of the letter, but not about writing an effective one that will have its intended result on the recipient.

We might first pause a moment to consider the difference between written and oral communication. Speaking and listening comes quite naturally to us. Humans have been around speaking for well over 50,000 years (estimates going back to 200,000 years) - before formal schools and before written

language. It is much more natural to us. Written language appears to have developed for commerce to allow for keeping track of inventory, of who owes what to whom, and other similar types of information (Spar, 2004.) It was a way to record information in a more permanent and precise way and could be looked at repeatedly, without the need to rely on individual's memory or accuracy. This is why contracts today are typically written and are much preferred to oral contracts. So, writing was developed for practical reasons and not for the purpose of composing great literature. In fact, we know that Homer's *Iliad* and *Odyssey*, probably written in the eighth century, existed as oral poetry for hundreds of years before they were reduced to written form (Cartwright, 2017.)

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persuaded *through our words* to comply. The use of unclear language, including the use of big words or jargon that is not likely to be understood should be avoided. So, for example, don't use the word "sesquipedalian" (a big word for a big word) unless you're speaking to a group of authors or to your English department's faculty.

A second important point about writing in business is that it should be written succinctly. A remark in a letter written by Blaise Pascal in 1657 that has been repeated in some form and attributed to many others is:

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A third important point about writing is that it tends to be one way. I write and you read. Of course, you can write back, but it can take time. With a written letter this could be a week or more

(hence the term "snail mail." Even with email you must wait for the recipient to read your email and then write a response. If you need to go back-and-forth several times it may not be the most efficient way of getting to any conclusion; writing may not be the best choice here and a face-to-face or telephone conversation may be much better in that case. So, writing is best when a more permanent record is needed, or when precision is needed, and a lot of back and forth between the two parties is not required. Also, as you have already learned, without body language or the human voice (with its pitch, inflection, cadence etc.), many of the tools you can use in face-to-face or telephone conversations are taken away in written communication. This makes it more difficult to convey what you want to communicate and to discern what your partner wishes to communicate. There is the potential for meanings to be lost. This needs to be considered as you write and read, since meaning can be conveyed *only through the words on the page*.

### **E-mail Writing:**

The virtue of the email over other forms of written communication is the speed and ease with which information can be sent. This has led to it being a primary mode if not the primary mode of communication in the workplace. One estimate is that for many, writing and replying to emails can consume over a quarter of one's workday (McKinsey Global Institute analysis, 2012.)

Because of the ease of writing, it's understandable that many approach email writing in a more casual way than other types of writing. On the other hand, from the receiver's point of view, with tens to possibly more than a hundred emails in the inbox, it becomes a daunting task to get through them and give each one its proper due, making sure that the most important and those requiring the most immediate action are given priority.

These characteristics have implication for writing good emails in the workplace and also for responding to them with the goal of increasing clear communication, efficiency, and getting the result you desire by your email or your reply. The implication for the writer is to keep emails succinct and make it easy for the receiver to understand the communication and what the sender is requiring of him or her. Unnecessary socialization, or requests embedded in a sea of words that the receiver needs to pluck out, tax the receiver who has all those other emails to get to. The reader may get confused about what is required and pluck out the wrong item or misinterpret the response that is asked for. This results in wasted time for the reader, and failure to get the desired outcome by the sender. We will specifically look at some good practical tips for writing and reading though emails and you will have an opportunity to practice writing effective emails in the workplace.

### **Objective:**

Here's an overview of activities for this lab:

In Activity # 1 you will listen to a short video on writing clearly and understandably in workplace settings. You will then have an opportunity to rewrite a very famous document from American history using what you have learned in the video.

In Activity #2 you will have an opportunity to write a repair order using your text's guidance in preparing it. One of you will be the "complainer" who needs something repaired, and another of you will play the role of the SCT who will write things up giving your diagnosis of the situation (the "cause" in your text) and how you fixed the problem (the "remedy," in your text.)

In Activity # 3 you'll look at a talk about practical tips for writing good business emails and then have an opportunity to rewrite an email using the tips that you learned about, remembering to use clear and simple language as you do your rewrite, and to help the reader understand exactly what is asked of him or her.

### **Equipment:**

No special equipment is needed other than a computer, tablet, or smartphone to view the videos for Activity #1 and Activity #3.

### **Procedures:**

Your class should be divided into groups of 4 students or as your instructor deems appropriate. Note that three activities are presented. Your instructor may choose which to include, depending on the time available and the focus of your class.

**Procedures for Activity #1:** Read the Harvard Business Review article by Josh Bernoff and listen to the TED talk by Alan Siegel about the need for clear and simplified language in written communication.

The article, titled [\*\*Bad Writing Is Destroying Your Company's Productivity\*\*](#) (2016,) is about the importance of clear writing in the work place with examples of good and bad business writing. The TED talk, titled [\*\*Let's Simplify Legal Jargon\*\*](#), explains how writing clearly, simply and transparently can improve written communications and have an important effect on the reader.

Read the article and listen to the talk. After commenting on these (see directly below) you should read the opening passages of the *Declaration of Independence* reprinted below, which you will be rewriting based upon what you've learned in the article and the talk.

### **Analysis:**

Write briefly the most important point you took from the article and then write the most important point you took from the talk.

After this, read through the opening passages of the *Declaration of Independence* that was written by Thomas Jefferson and is reprinted below. The statement was a declaration to the world, and so would justify a formal, elaborate, perhaps poetic style of writing. It is certainly one of the most masterful and memorable

pieces of writing in the English language. But now suspend your associations and reverence for the document and reimagine it anew, as if this were a business memo explaining the need for separation. How might you rewrite this, keeping in mind brevity, clarity, transparency and persuasiveness? Microsoft makes one edit – replacing “in the Course of” with “during” along with a few changes in punctuation and replacing the word “effect” with “affect.” See if you can improve on these edits.

Write your finished business version of the document. You should work together as a group on your summary to produce your version of this masterwork.

Here are the opening passages:

When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.--That to secure these rights, Governments are instituted among Men, deriving their just powers from the

consent of the governed, --That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security.--Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States.

### **Interpretation:**

Each of you will have your own reactions to the article and to the talk but you should all should see the importance of simple, clear,

transparent, and persuasive writing to get the results you hope to achieve.

The rewrite of the Declaration of Independence as a piece of business writing is purely an exercise to improve your writing skills. It should include the key points of Jefferson's argument for separation from Great Britain.

The thread of the argument is as follows. Leaving a political structure is a serious act with many consequences, so people are owed an explanation and justification, which the Declaration is. It is obvious and without any need for further justification that one person's life carries equal weight to any other person's, and that we are all entitled (by the Creator – not something given to us by a person or by society.) to our lives, our freedom, and the right to pursue our goals for a fulfilling life. Jefferson was a Deist who believed that there was a Creator. He believed that Jesus was a great moral teacher but not in his divinity. With this a backdrop, he argues the purpose of a government is fundamentally to achieve these entitlements. Therefore, when a government such as that of Great Britain acts in hindrance of these through tyrannical imposition of its power, the people are fully justified in withdrawing from this political structure and setting up one that will achieve the ends that a government should rightfully pursue. He adds that it is not enough for a small breach to justify a full-blown rejection of a government in favor of another, but when there is a consistent pattern of tyranny that interferes with basic



human rights then the separation becomes justified. The actual tyrannies of Great Britain are listed immediately following these opening passages in support of this separation.

Although your rewrite should avoid all the flowery language, which is very poetic and beautiful, it should convey the heart of the argument simply, clearly, and persuasively so the reader will understand why the separation was necessary.

**Procedures for Activity #2:** Reread your text on writing Preventative Maintenance Orders, Repair Orders, and Emergency Repair Orders, pp. 274-277. Afterwards you will practice writing your own Repair Order.

One of you in your group will document the complaint as a supervisor might (the “complainer” role.) Another of you will play the role of the SCT and fill out the balance of the form. Ideally, you can all discuss a breakdown of some piece of equipment that you are all familiar with. To take cars, as an example, a problem might be that the car’s radiator is running hot, or that the car fails to start. **The complainer should write a somewhat vague complaint**, lacking detail, on the report. The SCT will now have to fill out the balance of the report – making a diagnosis (the “cause” in your text) and documenting what repair was made (the “remedy” in your text.) To get more information from the complainer before reaching your diagnosis, **you ought to spend a few minutes talking to the complainer and obtain more**

**detail** on the complaint to help you complete the cause section of the form. Complete the cause and remedy section after this. A simulated 2-page order form for you to work with is provided on the next two pages.

### **Analysis:**

All of you should discuss how the complainer could have written a better complaint instead of the vague one that was written, now that it is understood in greater detail what the problem was. You should also discuss the diagnosis and remedy section and how the Repair Order form might be further improved. After your discussion, work together on rewriting the Repair Order form as a final product of your work together. A simulated 2-page order form for you to work with is provided on the next two pages.

Activity #3 on writing effective emails will follow these next two pages.

### **Interpretation:**

Ideally, as an SCT, the complaints you receive on work orders will help you to diagnose what the problem is. Knowing if the problem is always there or only there under certain conditions can prove very helpful in reaching your conclusion. Through questioning the complainer about the problem, you should all appreciate how the added detail will improve the accuracy of the diagnosis. The reason for choosing an item that you’re familiar

with is so that you can write down a plausible diagnosis and remedy. As an example, if the complaint is that the car doesn't start, you might learn that this happened when a dome light was left on all night and the battery discharged. A simple recharge would fix the problem. On the other hand, if recharging doesn't help and the car fails to start soon after the recharge, a bad battery may be the culprit and it may need replacement. If the battery proves to be good, it might be a bad alternator that fails to recharge the battery, and this may need to be replaced. In the remedy section you might write that you tested the battery and it failed to hold a charge. You then replaced the battery and the car started immediately. You tried it again several times during the day with no problem so that now you are confident that the problem has been corrected.

**NOTE: THE 2-PAGE WORK ORDER FORM FOLLOWS ON THE NEXT TWO PAGES.**

**REPAIR WORK ORDER:**

To file a work order please fill out all underlined and italicized information.

ABC Company  
123 Warehouse Drive  
Enid, OK 73701  
580-987-6543

INTERNAL REPAIR WORK ORDER

DEPARTMENT                      ORDER REQUESTED BY

EXTENSION                      ORDER RECEIVED BY

ORDER DATE                      EXPECTED START DATE                      EXPECTED END DATE

WORK AUTHORIZED BY

PERMISSION TO ENTER SPACE    ANYTIME                      BY APPOINTMENT                      DATE                      TIME

REQUESTED WORK DESCRIPTION (This is the complaint from your text.)

ADDITIONAL COMMENTS

WORK PERFORMED BY (To be completed by technician.)

CAUSE (To be completed by technician. This is the technician's diagnosis of the problem.)

DESCRIPTION OF WORK COMPLETED AND MATERIALS USED (To be completed by technician)

(This is the remedy from your text.)

WORK ORDER COMPILED BY  
(To be completed by technician)

COST OF LABOR     \$-

CLIENT APPROVAL NAME AND TITLE  
(To be completed by technician)

COST OF MATERIALS     \$-

APPROVING PARTY SIGNATURE

TOTAL     \$-

DATE OF APPROVAL

CHARGEABLE TO



**Procedures for Activity #3:** Look at the You Tube video by David Taylor who teaches business and technical writing at the University of Maryland University College, *Top 10 Email Hacks* (2018.)

You will then have an opportunity to rewrite an email using the information you've learned in this lab and particularly from the video. Note: There is a second You Tube video by David Hendrikz, a South African professional trainer, on the same topic. Although there is some overlap, the second video does add some new tips and I would encourage you to view it as well, perhaps before the start of the lab. Each video is about 13 minutes.

View the Taylor video. Each of you should write down two important tips that you learned from the Taylor video (and the Hendrikz video if you were able to look at that as well.) Next, read through the email below which you will be asked to rewrite. Here is the email:

Date: June 4, 2018

From: Alfred Parkinson, Repair Services

To: Michael McMillan, V.P. of Human Resources

Subject: Repair Staff

Hi Mike,

It's been a while since I've seen you and I hope you are doing well. Your boy just started at Indiana. How's that going for him?

I'm working now on a proposal and I'm hoping you can help. The idea is to consider increasing our repair staff and also increasing the efficiency of our dept since lately we seem to be behind the 8-ball more times than I can count. If you could chime in with some additional information, it would be extremely helpful as I work through this. I guess I'd like to learn how long people in our dept. stay with us on average. I'm thinking if we could lower the turnover rate, which I suspect is on the high side compared to depts. elsewhere, we could push up the average experience level of the dept and thereby increase our efficiency. Also, I'm wondering if our salary schedule is competitive for our repair staff. If not, this may explain a higher turnover rate if in fact this is the case. Also, if we're not competitive, we might not be attracting the most highly skilled people which is why it always takes longer than I think it should.

I need my proposal ready by a week from Thursday and any thoughts would be helpful.

Cheers,

Al

P.S. Do we have any extra money in the budget to use for another couple of positions? It would make a big difference. Let me know, please.

**Analysis:** Using the information in the Taylor video (and the information in the Hendrikz video if you were able to view that) and whatever else you've learned about writing in this lab, each member of your group should individually rewrite the email. After completion, each of you should read your email for your group who should give some constructive criticism. Afterwards, work together to construct the best rewrite and submit this as your final work product along with the original rewrites that each of you did prior to your discussion with the rest of the group.

Interpretation: The email can be improved on multiple fronts. Here are some deficiencies of the email to consider, that the suggestions in the Taylor and Hendrikz videos would help to improve.

Subject Line:

The subject line is extremely vague and forces the reader to open the email to have any understanding of what it's about. He cannot tell if he needs to do anything, and if so when. This email may become buried if there are an abundance of emails.

Body of the email:

Over use of socialization:

The socialization can be eliminated or at least reduced substantially.

Style of the body:

Rambling narrative makes it difficult to identify what is needed from the reader. One long paragraph needs breaking up, with a list format or with separate paragraphs for each piece of information that is needed. The explanation of why this is all needed is probably not necessary unless the sender believes that without justification the receiver will not comply fully. The P.S. hangs by itself and may not be responded to. The P.S. should be rewritten into the body of the email.

Required Action:

The narrative style makes it difficult to discern exactly what is required of the reader.

The time frame is also not clear. When must the sender receive the information to use it? This should be made clear.

Close:

Research has shown that when requesting something, the best close is “thanks” or even better “thanks in advance.” (See the Hendrikz video on this.)

Signature:

There is no contact information in the email such as email address, or telephone number, burdening the reader to locate these if needed. Internal emails often come only with a name and the information may need to be passed on to someone else. The reader may find it more appropriate to call and without the number the reader is again unnecessarily burdened. (See the Hendrikz video on this.)

### References:

[\*\*Bernoff, J. \(2016\). Bad writing is destroying your company's productivity, Harvard Business Review.\*\*](#)

The above article explains how good writing can either assist or impede a company's productivity. Bernoff compares two public releases, one by Marissa Meyer, CEO of Yahoo, and another by Tim Cook, CEO of Apple, and contrasts their writing. There are a number of areas pointed out where the author shows how good writing translates to a more productive business, and how poor writing reflects poor thinking and reduce productivity.

[\*\*Cartwright, M. \(2017\). Iliad. Ancient History Encyclopedia.\*\*](#)

This is an article about the Iliad and is found in the Ancient History Encyclopedia. It explains that the Iliad existed hundreds of years prior to it being reduced to written form by Homer – or by an unknown group of writers that have been ascribed to a man called Homer, who may not have existed.

Chui, M., Manyka, J., et al. (2012). The social economy: Unlocking value and productivity through social technologies, McKinsey Global Analysis Report.

The is the McKinsey Global Institute report and analysis on the time spent dealing with emails in the workplace.

**Movie 3.13** Hendrikz, D. How to write a business email video tutorial, YouTube Video (April 2014.)



Tap to view a video

Hendrikz is a professional trainer from South Africa who provides many basic tips on good email writing. There is some overlap with the Taylor video but there are additional tips here not found in the Taylor video. It is worth going through.

**[Mark, J. J. \(2011\). Writing. Ancient History Encyclopedia.](#)**

This article from the Ancient History Encyclopedia is also about early writing including the origins of writing. You may find this of interest. It does reemphasize the development of language for business and for clarity.

**[Spar, Ira \(2004\). “The origins of writing.” In Heilbrunn Timeline of Art History. New York: The Metropolitan Museum of Art, 2000–.](#)**

Spar is on the staff of the Metropolitan Museum of Art. His brief article traces the origins of writing. It explains how written language was developed for business purposes (trade) and that the movement from pictograms to more general symbols was in the service of increasing clarity and precision in human communications.

**Movie 3.14** Taylor, D., Top 10 email hacks, You Tube Video (Jan. 2018.)



Tap to view a video

Taylor teaches business and technical writing at the University of Maryland University College. The focus is on practical advice when constructing emails.

**[If I Had More Time, I Would Have Written a Shorter Letter](#)**

This link gives a reference to Blaise Pascal quote, “If I had more time I would have written a shorter letter.”

**[Effective Email Communication](#)**

This is from the writing center at the University of North Carolina in written format that also lists many tips. This gives you another practical reference.

# Activities for Lab Periods Downloads

## Chapter 1:

[Supply Chain Technician Career Awareness Lesson Plan](#)

[Career Awareness Presentation Outline and Support](#)

Career Awareness Presentation: [PowerPoint](#) | [PDF](#)

## Chapter 7:

[Using a Multimeter – Checking the Test Leads & the DMM](#)

[Using a Multimeter to Measure Current](#)

[Using a Multimeter to Measure Voltage](#)

[Using a Multimeter to Measure Resistance](#)

## Chapter 9:

[Create a Basic PLC Program](#)

[Create an Advanced PLC Program](#)

## Chapter 10:

[Identifying Tag Types](#)

[Activating an RFID Tag](#)

## Chapter 12:

[Shielded Metal Arc Welding Lab - Basic](#)

## Chapter 13:

[Active Listening](#)

[Body Language](#)

[Telephone Communications](#)

[Written Communications and E-mail](#)



Chapter 4

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# Review Solutions

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## Review 2.1 Solutions

| Topic 1                                                                                                                                                                                                                  | Topic 2                                                                                                                                                  | Topic 3                                                                                                                                                                                | Topic 4                                                                                                                                                                                                                          | Topic 5                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The process of moving materials &amp; information across international boundaries within the global network of connected facilities and transportation modes.</p> <p><b>What is “global logistics”?</b></p>           | <p>Products that are in the process of being transported from a supplier to a customer.</p> <p><b>What is in-transit inventory?</b></p>                  | <p>Moving products to a staging area for quick release and shipping instead of placing them into storage.</p> <p><b>What is cross docking?</b></p>                                     | <p>The key function of the shipping department.</p> <p><b>What is “loading”?</b></p>                                                                                                                                             | <p>Productivity, quality, response time, operating costs, labor costs, inventory costs, damage, depreciation, &amp; asset recovery.</p> <p><b>What are some performance measurements at a DC?</b></p> |
| <p>The movement, storage, control, and protection of materials and products throughout the process of their manufacture, distribution, consumption, and disposal.</p> <p><b>What is material handling logistics?</b></p> | <p>The process of sourcing and building product inventory to establish targets based on customer needs.</p> <p><b>What is “supply” in logistics?</b></p> | <p>A philosophy or technique that is making cross-docking more prevalent in the logistics industry.</p> <p><b>What is just-in-time inventory?</b></p>                                  | <p>These may include carrier selection, product labeling, palletization, floor loading, product segregation, pallet stretch wrapping, weighing, &amp; preparing shipping documents.</p> <p><b>What are shipping methods?</b></p> | <p>The time it takes to process an order from the time the order is received from the customer until the order is delivered.</p> <p><b>What is “order cycle time”?</b></p>                            |
| <p>The force driving a product through its life cycle.</p> <p><b>What is the customer?</b></p>                                                                                                                           | <p>Receiving, stocking, order processing, and shipping?</p> <p><b>What are the four basic functions in a warehouse or distribution center?</b></p>       | <p>The practice of assembling products from various locations within the warehouse or distribution center for a specific customer order.</p> <p><b>What is “order processing”?</b></p> | <p>The area where orders are usually audited.</p> <p><b>What is the loading area or staging area?</b></p>                                                                                                                        | <p>Cartons delivered per mile driven, total cost per mile, cost per stop on delivery route, &amp; cost per carton.</p> <p><b>What are some transportation measurements?</b></p>                       |
| <p>Inventory consisting of materials ready for use in productions.</p> <p><b>What are raw materials?</b></p>                                                                                                             | <p>A critical function and first step in a typical warehouse or distribution center.</p> <p><b>What is “receiving”?</b></p>                              | <p>The term normally associated with order processing and can include full-case, repack, &amp; bulk or pallet picking.</p> <p><b>What is “picking”?</b></p>                            | <p>This physically connects the sources of supply with customers.</p> <p><b>What is transportation?</b></p>                                                                                                                      | <p>Bottom line, this is the main productivity measure for logistics.</p> <p><b>What is “efficiency”?</b></p>                                                                                          |
| <p>Inventory that is currently being worked on.</p> <p><b>What are work-in-process or WIP?</b></p>                                                                                                                       | <p>Assigning products to the proper location within the warehouse or distribution center.</p> <p><b>What is stocking?</b></p>                            | <p>It is normally done in the repack area, if there is one.</p> <p><b>What is “packaging”?</b></p>                                                                                     | <p>Truck, air, rail, &amp; water</p> <p><b>What are the four basic modes of transportation?</b></p>                                                                                                                              | <p>Logistics was primarily developed by this branch of the government.</p> <p><b>What is the military?</b></p>                                                                                        |



Review 2.3 Solutions

| Topic 1                                                                                                                                                                          | Topic 2                                                                                                                                                                                                   | Topic 3                                                                                                                                                                                                                            | Topic 4                                                                                                                                                                                                       | Topic 5                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The orderly receipt of materials and disbursing those materials to storage.</p> <p><b>What is “receiving”?</b></p>                                                            | <p>These types of forklifts are the most widely used because they are more environmentally friendly.</p> <p><b>What are electric forklifts?</b></p>                                                       | <p>This type of equipment allows an operator to be lifted with the load to allow for picking less-than-full-pallet loads.</p> <p><b>What is an “order picker”?</b></p>                                                             | <p>This device can bridge the gap between the dock and a trailer.</p> <p><b>What is a dock board or dock plate?</b></p>                                                                                       | <p>This type of system does not require a person to operate it but instead is guided by rails, tracks, or laser technology to guide it around obstacles.</p> <p><b>What is an Automated Guided Vehicle or AGV?</b></p>                                             |
| <p>This equipment is generally not used in large warehouses/DCs but may be used in a parts room or an office environment.</p> <p><b>What is a “hand-truck” or a “dolly”.</b></p> | <p>Traditional sit down fork trucks are powered by these.</p> <p><b>What are propane, gas, or electricity?</b></p>                                                                                        | <p>On this truck the forks are mounted perpendicular to the direction of travel to allow for side-loading and straddle load support.</p> <p><b>What is a “sideloader”?</b></p>                                                     | <p>This type of conveyor is typically positioned at an angle instead of using a motor.</p> <p><b>What is a gravity conveyor?</b></p>                                                                          | <p>This is a large, rail-running, robot-like vehicle that operates in aisles between storage racks in order to store &amp; retrieve loads.</p> <p><b>What is an Automated Storage/ Retrieval System or AS/RS?</b></p>                                              |
| <p>This equipment can be manual or battery powered and is primarily used to move single pallets of products over short distances.</p> <p><b>What is a pallet jack?</b></p>       | <p>This type of equipment is mainly used in rack areas of a warehouse/ DC because it does not require as wide an aisle as a regular counterbalance truck.</p> <p><b>What is a narrow-aisle truck?</b></p> | <p>This equipment is widely used in many warehouse for moving large bulky items that are typically stored on the floor in bulk locations &amp; are equipped with paddles to grip the cartons.</p> <p><b>What is a “clamp”?</b></p> | <p>This type of conveyor allows packages to be moved horizontally on a flat plane or even vertically.</p> <p><b>What is a powered conveyor?</b></p>                                                           | <p>This electric equipment comes in 3 types...in one, the operator walks along with the as he/she moves it, while in the other the operator can ride on the front of it as it moves.</p> <p><b>What are “electric pallet trucks” or “rider pallet trucks”?</b></p> |
| <p>This is the full name for what most people call a forklift.</p> <p><b>What is a “counterbalance truck?</b></p>                                                                | <p>This is probably the most common piece of equipment in a warehouse/DC.</p> <p><b>What is a sit-down counterbalance truck?</b></p>                                                                      | <p>This is a fork lift with pneumatic tires which allow for operation on rough areas.</p> <p><b>What is a yard lift?</b></p>                                                                                                       | <p>This type of conveyor system can be used to move materials throughout a facility with little or no human involvement.</p> <p><b>What is an automated conveyor system?</b></p>                              | <p>This type of equipment can handle up to 6,000 pounds &amp; is most often used in high-volume shipping &amp; receiving operations.</p> <p><b>What is a sit-down counter balance truck?</b></p>                                                                   |
| <p>These types of forklift can travel faster &amp; handle heavier loads than others.</p> <p><b>What is a propane lift truck?</b></p>                                             | <p>In the full-name for a forklift, this term refers to the weight of the truck balancing the weight of the load keeping the truck from tipping over.</p> <p><b>What is “counterbalance”?</b></p>         | <p>This can be a portable of stationary device which lifts a platform to the height of the trailer or railcar deck.</p> <p><b>What is a “scissor lift” or “portable platform”?</b></p>                                             | <p>This type of crane uses a bridge beam with a powered or manual hoisting mechanism and usually has wheels on the floor end for easy movement around a facility.</p> <p><b>What is a “gantry crane”?</b></p> | <p>This type of equipment has been developed more recently to make better use of cubic space &amp; uses a turret truck that can rotate 180 degrees.</p> <p><b>What is “Very Narrow Aisle” equipment?</b></p>                                                       |

Review 2.5 Solutions

| Topic 1                                                                                                                                                                                                                                           | Topic 2                                                                                                                                                              | Topic 3                                                                                                                                                                     | Topic 4                                                                                                                                                                         | Topic 5                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>These people must be well-trained on the use of any piece of equipment that they operate, including safety processes involved.</p> <p><b>What are workers?</b></p>                                                                             | <p>Before manually picking up a load it should always be tested for these 2 things.</p> <p><b>What are stability and weight?</b></p>                                 | <p>A PPE used to protect from falling objects, water, dirt, sparks, etc.</p> <p><b>What is a hard hat?</b></p>                                                              | <p>These two are for above 85 decibels for an average 8-hour day.</p> <p><b>What are earplugs and earmuffs?</b></p>                                                             | <p>These are the 2 basic types of maintenance for logistic equipment.</p> <p><b>What are “corrective maintenance” or repairs and “preventative maintenance”?</b></p>      |
| <p>“Seizing, holding, grasping, turning or otherwise working with the hand or hands.”</p> <p><b>What is “manual material handling” according to the U.S Department of Labor?</b></p>                                                              | <p>When picking up a load manually, the area above the knees, below the shoulders, and close to the body is known as this.</p> <p><b>What is the power zone?</b></p> | <p>This is a PPE to protect against burns, cuts, pinches, and chemical or biohazard exposure.</p> <p><b>What are gloves?</b></p>                                            | <p>In the U.S alone, over 1000 warehouse employees died from using these between 1980 and 2004.</p> <p><b>What are forklifts?</b></p>                                           | <p>To ensure safety and cost effective operations, this must be performed on all types of logistics equipment.</p> <p><b>What is maintenance?</b></p>                     |
| <p>Physical conditions like force, awkward postures &amp; repetitive motions can lead to these 3 things, among other things.</p> <p><b>What are injuries, wasted energy, &amp; wasted energy?</b></p>                                             | <p>This is the term for items such as gloves, safety goggles, hard hats, &amp; steel-toed boots.</p> <p><b>What is Personal Protective Equipment (PPE)?</b></p>      | <p>These are 2 types of PPE that can be used to protect from airborne dust, fibers, particles, and dangerous fumes.</p> <p><b>What is a dust mask and a respirator?</b></p> | <p>They are responsible for providing safe operation information about their product.</p> <p><b>What is the manufacturer?</b></p>                                               | <p>Inspecting the machinery prior to use each day, according to <u>this</u> is one form of preventative maintenance.</p> <p><b>What is a “maintenance checklist”?</b></p> |
| <p>Injuries to back, shoulders, hands, wrists, or other parts of the body cause by repeated or continual exposure to one or more risk factors that may lead to fatigue or discomfort.</p> <p><b>What are musculoskeletal disorders (MSD?)</b></p> | <p>They are required to perform a hazard assessment at a workplace to determine if employees should wear PPE.</p> <p><b>What is an employer?</b></p>                 | <p>The most common PPE work in the warehouse/DC environment.</p> <p><b>What are steel-toed boots?</b></p>                                                                   | <p>These are used at docks and operate in pairs with one set on the interior or the warehouse and the other on the exterior.</p> <p><b>What are “communication lights”?</b></p> | <p>In large companies, preventative maintenance may be performed by this group of people rather than by the operator.</p> <p><b>What is a maintenance crew?</b></p>       |
| <p>For safer manual material handling, this is most effective when it is interactive and fully involves workers.</p> <p><b>What is training?</b></p>                                                                                              | <p>This is what any employee working in an area that the employer has determined to need PPE must receive.</p> <p><b>What is training?</b></p>                       | <p>These are 3 types of PPE used to shield eyes from heat, impact hazards, chemicals and dust.</p> <p><b>What are safety glasses, goggles, or safety shields?</b></p>       | <p>Warehouse equipment usually has this based on weight and/or volume.</p> <p><b>What is a “capacity limit”?</b></p>                                                            | <p>In addition to communication lights, some dock doors are equipped with these to warn when a door is about to open or close.</p> <p><b>What are audible alarms?</b></p> |

Review 2.7 Solutions

| Topic 1                                                                                                                                                                                            | Topic 2                                                                                                                                                                               | Topic 3                                                                                                                                                                             | Topic 4                                                                                                                                                                                        | Topic 5                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>These are the general 2 type of communications.</p> <p><b>What is “internal” and “external”?</b></p>                                                                                            | <p>This is what most failures in logistics can be attributed to.</p> <p><b>What is breakdowns in communication?</b></p>                                                               | <p>A type of communication where you should to identify your purpose, consider your audience, have clarity, &amp; proofread.</p> <p><b>What is written communication?</b></p>       | <p>A common source of mistakes in the supply chain.</p> <p><b>What is lack of communication?</b></p>                                                                                           | <p>This is commonly referred to as “EDI”.</p> <p><b>What is “electronic data interchange”?</b></p>                                                       |
| <p>This is a type of communication that is between workers, between shifts, &amp; between workers &amp; supervisors.</p> <p><b>What is “internal” communication?</b></p>                           | <p>A complex network of suppliers, manufacturers, transporters, and customers.</p> <p><b>What is the supply chain?</b></p>                                                            | <p>A set of skills that include previewing, questioning, &amp; visualizing.</p> <p><b>What are reading skills?</b></p>                                                              | <p>Communicating clearly, accurately, and professionally is an important factor for these 2 general types of communications.</p> <p><b>What are internal &amp; external communication?</b></p> | <p>These 2 modern technologies can provide for communications with a customer 24/7.</p> <p><b>What is the Internet and EDI?</b></p>                      |
| <p>This is the type of communication that goes on with customer, vendors, suppliers, transporters, &amp; any other group outside the company.</p> <p><b>What is “external” communications?</b></p> | <p>This can cost companies millions of dollars in lost time &amp; materials.</p> <p><b>What are communication problems?</b></p>                                                       | <p>A set of skills that include looking at the speaker, asking questions, not interrupting, &amp; restating what the speaker has said.</p> <p><b>What are listening skills?</b></p> | <p>Calling &amp; speaking with a customer about a problem with an order is an example of this type of communication.</p> <p><b>What is an example of external communication?</b></p>           | <p>You should always do this if you have told someone you would get back to them with an answer or clarification.</p> <p><b>What is “follow up”?</b></p> |
| <p>An exchange of information.</p> <p><b>What is a “communications”?</b></p>                                                                                                                       | <p>Speaking too fast, entering wrong delivery dates, &amp; not listening to instructions.</p> <p><b>What are some communication problems?</b></p>                                     | <p>These are 3 active communication skills.</p> <p><b>What are listening, reading &amp; speaking?</b></p>                                                                           | <p>Explaining to the maintenance staff of a problem with a machine is an example of this type of communication.</p> <p><b>What is an example of internal communications”?</b></p>              | <p>This involves a sender, a message, transmission, interpreting, &amp; receiving.</p> <p><b>What is the communication process?</b></p>                  |
| <p>Communication needs to be sent this way and received with this in order to be effective.</p> <p><b>What is sent clearly &amp; received with understanding?</b></p>                              | <p>A type of communication where you should consider your audience, check for understanding, speak clearly, &amp; use appropriate tone.</p> <p><b>What is oral communication?</b></p> | <p>Of the 4 communication skills, this one is passive.</p> <p><b>What is writing?</b></p>                                                                                           | <p>This is a document issued by the carrier, which the consignee signs as proof of receipt.</p> <p><b>What is a “delivery receipt”?</b></p>                                                    | <p>Asking a listener if he or she has any questions.</p> <p><b>What is checking for understanding?</b></p>                                               |



## Review 2.9 Solutions

| Topic 1                                                                                                                                                          | Topic 2                                                                                                                                                                                                           | Topic 3                                                                                                                                                                          | Topic 4                                                                                                                                                                  | Topic 5                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Skills with this technology are needed for success in the logistics industry.</p> <p><b>What are computers?</b></p>                                           | <p>Inventory control department, shipping &amp; receiving clerks, and warehouse supervisors.</p> <p><b>Who are the most common groups that will have access to a wide range of computer programs in a DC?</b></p> | <p>The most popular word processing application on the market today.</p> <p><b>What is Microsoft Word?</b></p>                                                                   | <p>This allows employees to input a variety of inventory information such as quantity, location, status, &amp; other relevant data.</p> <p><b>What is WMS?</b></p>       | <p>Most mistakes in logistics are caused by this.</p> <p><b>What is human entry error?</b></p>                                                                                                                    |
| <p>A connection of millions of computers around the world.</p> <p><b>What is the Internet.</b></p>                                                               | <p>The most frequently used application on the Internet.</p> <p><b>What is email?</b></p>                                                                                                                         | <p>Computer applications or software that contains grids of columns and rows which form cells that can be manipulated &amp; calculated?</p> <p><b>What are spreadsheets?</b></p> | <p>This type of software or application is used by companies to handle contact with customers.</p> <p><b>What is Customer Relations Management or CRM software ?</b></p> | <p>These are the 4 basic technologies used to capture data and transmit it into the system.</p> <p><b>What are bar codes, RFID tags, magnetic stripe, and optical systems?</b></p>                                |
| <p>These are the 2 most common uses of the Internet in logistics.</p> <p><b>What are purchasing and transportation?</b></p>                                      | <p>The words after the @ sign and before the dot in an email address.</p> <p><b>What is the name of the company or organization used on the Internet..or the “domain name”?</b></p>                               | <p>A commonly used spreadsheet application.</p> <p><b>What is “Microsoft Excel”?</b></p>                                                                                         | <p>These are scanned to enter items directly into WMS.</p> <p><b>What are barcodes or RFID tags?</b></p>                                                                 | <p>This is used by optical systems to capture information which is interpreted by computers and is most popularly used by the U.S Postal Service.</p> <p><b>What is Optical Character Recognition or OCR?</b></p> |
| <p>Checking price quotes, claims management, and pickup &amp; delivery operations.</p> <p><b>What are typical applications of the Internet in logistics?</b></p> | <p>The part before the @ sign in an email address.</p> <p><b>What is the user name?</b></p>                                                                                                                       | <p>These can be printed and used by logistics workers to analyze operations, show inventory status, or indicate transport modes.</p> <p><b>What are spreadsheets?</b></p>        | <p>The primary purpose of this is to control the movement and storage of materials within a warehouse.</p> <p><b>What is WMS or Warehouse Management System?</b></p>     | <p>A technology most commonly used on ID cards by personnel for security or identification purposes.</p> <p><b>What is mag stripes?</b></p>                                                                       |
| <p>This is the main reason for restricting computers to “company programs” in a DC.</p> <p><b>What is security?</b></p>                                          | <p>A computer application used for composing, editing, formatting, &amp; printing a document.</p> <p><b>What is a word processor?</b></p>                                                                         | <p>Used for inventory control, this is the most widely used application in warehouse operations.</p> <p><b>What is WMS or Warehouse Management System?</b></p>                   | <p>This software system is designed to manage transportation operations.</p> <p><b>What is a T M S or Transportation Management System?</b></p>                          | <p>RFID uses this type of code and is universal to all compliant systems.</p> <p><b>What is EPC or Electronic Product Code?</b></p>                                                                               |

## Review 2.11 Solutions

| Topic 1                                                                                                                                                                                             | Topic 2                                                                                                                                                             | Topic 3                                                                                       | Topic 4                                                                                                                                                                                                                                                                                      | Topic 5                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <p>Merchandise that is returned is referred to as this.</p> <p><b>What is “reverse inventory”?</b></p>                                                                                              | <p>These are items placed on the outside of a vehicle or container to warn that a hazmat is inside.</p> <p><b>What are “placards” or signs?</b></p>                 | <p>The most expensive logistics activity.</p> <p><b>What is transportation?</b></p>           | <p>A document issued by the carrier as proof-of-delivery.</p> <p><b>What is a delivery receipt?</b></p>                                                                                                                                                                                      | <p>This popular book was written by Herman Melville and originally only sold 50 copies.</p> <p><b>What was “Moby Dick”?</b></p>   |
| <p>Choosing the right amount of the right materials to be used during a specific period of time is referred to as this.</p> <p><b>What is “just-in-time inventory”?</b></p>                         | <p>Legibly and in English.</p> <p><b>How must hazmat descriptions on shipping papers be written?</b></p>                                                            | <p>The most expensive.</p> <p><b>What is air transportation?</b></p>                          | <p>These are 2 ways goods can be tracked.</p> <p><b>What are bar codes &amp; RFID tags?</b></p>                                                                                                                                                                                              | <p>It is called a “twit”?</p> <p><b>What is a pregnant goldfish called?</b></p>                                                   |
| <p>An inventory control method that says that the oldest items received are the first to be sold or delivered is referred to as this <u>acronym</u>.</p> <p><b>What is “FIFO”?</b></p>              | <p>A substance or material that is capable of posing an unreasonable risk to health, safety and property.</p> <p><b>What is a hazardous material or hazmat?</b></p> | <p>Water.</p> <p><b>What is the slowest mode of transportation?</b></p>                       | <p>This was done by the ISO to make international, intermodal transportation more efficient.</p> <p><b>What is standardizing containers?</b></p>                                                                                                                                             | <p>These machines kill 10 people each year?</p> <p><b>What are vending machines?</b></p>                                          |
| <p>With this type of inventory control system, the flow of materials is controlled so there is little or no mistake as to where materials are to go.</p> <p><b>What is an automated system?</b></p> | <p>Within 90-days of hiring.</p> <p><b>When must new hazmat employees be trained?</b></p>                                                                           | <p>In the U.S most goods are transported this way.</p> <p><b>What is “by truck”?</b></p>      | <p>These are 7 important factors when determining the best route for a shipment. <i>(Must name at least 4)</i></p> <p><b>What are distance, road closures, customer requirements, driver availability, vehicle restrictions, road constructions, &amp; delivery/ collection options?</b></p> | <p>This produces a new layer of mucus every 2 weeks otherwise it will digest itself?</p> <p><b>What does your stomach do?</b></p> |
| <p>This type of inventory system involves total inventory movement.</p> <p><b>What is aggregate inventory?</b></p>                                                                                  | <p>The government agency that provides the Hazcom Standards or “Right to Know” laws?</p> <p><b>What is OSHA?</b></p>                                                | <p>The best way to move gas, oil, and refined products?</p> <p><b>What are pipelines?</b></p> | <p>This government agency regulates the import of food &amp; cosmetics into the U.S?</p> <p><b>What is the FDA?</b></p>                                                                                                                                                                      | <p>These prophetic treats were invented in America in 1918 by Charles Jung?</p> <p><b>What are fortune cookies?</b></p>           |

## Review 2.13 Solutions

| Topic 1                                                                                                                                            | Topic 2                                                                                                                                                     | Topic 3                                                                                                                                                                                                          | Topic 4                                                                                                                                                                   | Topic 5                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <p>The orderly receipt of materials and disbursing those materials to storage.</p> <p><b>What is “receiving”?</b></p>                              | <p>This type of storage equipment results in fewer material handlers and higher throughput of materials.</p> <p><b>What is “AS/RS”?</b></p>                 | <p>These are two common scanning methods to verify order accuracy.</p> <p><b>What are visual and bar-code scanning?</b></p>                                                                                      | <p>Fragility of a product and customer shipping instructions are two of the factors considered when doing this.</p> <p><b>What is choosing the type of packaging?</b></p> | <p>The New Zealand Kiwi bird cannot do this.</p> <p><b>What is “fly”?</b></p>                                                     |
| <p>This person needs to be present when the seal or load is inspected.</p> <p><b>What is the carrier representative?</b></p>                       | <p>This typically referred to as AS/RS.</p> <p><b>What is an automated storage &amp; retrieval system?</b></p>                                              | <p>In this order picking method, each picker only picks items from their zone, one order at a time.</p> <p><b>What is the “zone system”?</b></p>                                                                 | <p>This is the container that a single product can be in.</p> <p><b>What is a “primary package”?</b></p>                                                                  | <p>El Pueblo de Nuestra Señora de los Angeles de Porciuncula.</p> <p><b>What is the full name of the city of Los Angeles?</b></p> |
| <p>This is a contract of carriage.</p> <p><b>What is a Bill of Lading?</b></p>                                                                     | <p>This is an inexpensive way to provide additional storage space over an area like a shipping area.</p> <p><b>What is a building a “mezzanine”?</b></p>    | <p>Order processing begins with this.</p> <p><b>What is the seller receiving an order?</b></p>                                                                                                                   | <p>These are the containers that can be placed on a pallet and can have secondary packages in them.</p> <p><b>What are “secondary packages”?</b></p>                      | <p>This is the tallest mammal in the world.</p> <p><b>What is a giraffe?</b></p>                                                  |
| <p>This should be noted on the delivery receipt and should be noted and acknowledged by the carrier.</p> <p><b>What is any product damage?</b></p> | <p>Pallets made from this material can handle extremely heavy loads that other types generally cannot handle.</p> <p><b>What are metal pallets?</b></p>     | <p>This term describes the process in which individually separate but related items are grouped, packaged, and supplied together as one unit.</p> <p><b>What is “kitting”?</b></p>                               | <p>This is the most common unit load used in a warehouse today.</p> <p><b>What are wooden pallets?</b></p>                                                                | <p>It is the plant used to make tequila.</p> <p><b>What is the agave plant?</b></p>                                               |
| <p>In many cases, a delivery is held in this area for final inspection.</p> <p><b>What is a staging area?</b></p>                                  | <p>Narrow-aisle, standard single-deep, deep-reach, and flow-through are all types of this kind of storage device.</p> <p><b>What are storage racks?</b></p> | <p>In this picking system, a gummed label is printed for each item to be picked. A picker attaches the matching gummed label to each item as it is picked.</p> <p><b>What is the “pick by label” method?</b></p> | <p>This has more to do with product damage than individual packaging.</p> <p><b>What is “how a trailer is loaded”?</b></p>                                                | <p>The president on the 50-dollar bill.</p> <p><b>Who is Ulysses S. Grant?</b></p>                                                |

## Review 3.1 Solutions

### Across:

- 2. Supply Chain Management** - The integration and coordinated execution of all the business processes used to plan and execute the flow of material, goods, products and related information.
- 3. Inventory Control** – Maintaining specified product quantity limits in a JIT (just-in-time) environment.
- 4. Just-In-Time (JIT)** - The practice of timing inbound material flows so that they can arrive before they are required.
- 5. Quality Control** – The process of ensuring that the finished product, service, or system meets the specified criteria and constraints.
- 6. Order Picking** - The process of retrieving individual items (from storage locations) for the purpose of fulfilling an order for a customer.
- 7. Benchmarking** - A measurement process that establishes goals, operating targets and production expectations and can be used for comparison in an effort to achieve maximum efficiency of operation
- 9. Receiving** – The incoming process for supplied items from suppliers
- 10. Cycle Time** - A measurement of time required to order, fulfill, and deliver products and stock items.
- 11. Kitting** - The light assembly of component parts and sub-assemblies. Performed primarily by warehouse personnel.
- 12. Shelf life** – The amount of time an item may be stored before it is unusable
- 13. Demurrage** - A term associated with the charge (monetary) that can be levied against a shipper or consignee who detains a container, truck, ship or railroad car beyond the allotted time for loading and unloading of that piece of transport equipment

### Down:

- 1. Material Handling** - The movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal.
- 8. Cross Docking** - The process of moving merchandise from the receiving dock to shipping without placing it first into storage locations
- 14. Staging** – Pulling or picking of materials to plan for shipping
- 15. Storage** – The retention of items or product for future use or shipment
- 17. Aisle** - The space between storage aids used by material handling equipment and/or personnel.
- 19. Queue** – A line of production
- 20. Backlog** – Orders that have been received but have not been shipped

## Review 5.1 Solutions

### Across

- 2. **Maintenance** – processes needed to keep equipment in operational condition and minimize production losses.
- 3. **Palletizing** – the practice of producing a transportable unit that can be moved, organized and shipped.
- 4. **Rollers** – devices used to support a belt conveyer for heavier loads and higher speeds.
- 5. **Sprocket** – metal wheel with teeth on the outside to drive or be driven by a chain.
- 6. **Sorter** – a device that delivers objects or packages by directing them to a pathway by identifying, inducting and conveying product to a specific destination.
- 8. **Robotics** – a type of equipment that increases accuracy and is used to replace human workers that do tedious, dull or time consuming processes.
- 9. **Conveyer** - a horizontal, inclined, or vertical device for moving or transporting bulk material, packages, or objects.
- 11. **Lockout** – device for controlling access to a device or area for security or safety during maintenance
- 12. **Pallet** – a device creating a base which is used for transporting goods as a unit by trucks or automated processes.
- 14. **Picker** – powered lift that raises an operator in a compartment to a level that allows for fulfilling less than pallet quantity orders.
- 16. **Drive** – provides power to a belt or chain.
- 17. **Guard** – mechanical device to shield workers from potential exposed hazards by making the danger zone inaccessible.
- 18. **Tugs** – driven device to tow trains of cage or flat carts.

### Down

- 1. **Thermography** – the use of heat imaging to determine, detect or locate if a potential failure of a component exists.
- 7. **Carousel** – storage device that moves like a dry cleaners storage using bins for small items and is under computer control
- 9. **Chute** – a device that transfers product to a lower level normally using gravity.
- 10. **Forklift** – driven device that is used for unloading and loading palletized material.
- 13. **Tote** – storage device that allows small or imperfect size items to be transported in a more manageable way in an automated warehouse system.
- 15. **Lifts** – driven device that places or retrieves materials at different heights.



Material Handling Terms

|              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carousel     | U | O | B | J | J | W | I | W | I | O | M | F | U | X | U | D | I | N | H | W | F | X | C | R | V | Q | V | C | W | T |
| Chute        | T | U | G | S | E | C | L | N | C | D | X | A | I | Q | R | P | O | S | B | E | P | B | R | B | O | J | L | B | M | V |
| Conveyer     | F | W | K | X | G | I | O | T | B | J | Z | B | I | K | X | K | C | U | B | F | P | Y | M | C | C | I | T | U | P | I |
| Drive        | V | J | G | O | J | W | C | Q | Y | V | N | B | M | N | A | I | D | K | Y | E | L | Q | B | L | Z | M | C | U | I | E |
| Forklift     | L | U | P | F | N | X | K | S | W | Y | Z | A | U | U | T | D | H | R | R | M | H | N | D | X | A | O | L | O | O | M |
| Guard        | K | P | A | U | O | N | O | L | Y | W | W | M | P | O | D | E | F | D | V | F | F | E | S | Q | A | B | S | X | F | G |
| Lifts        | V | A | L | B | S | V | U | S | O | B | R | S | B | G | Q | A | N | X | X | C | Y | V | T | T | Q | I | A | V | K | Q |
| Lockout      | H | C | L | X | T | O | T | Q | V | K | M | O | M | R | L | L | F | A | F | K | Z | O | F | L | K | D | I | C | E | Y |
| Maintenance  | U | W | E | Y | B | K | R | H | U | X | R | B | W | F | E | W | D | M | N | H | K | H | Z | B | G | M | E | Q | T | T |
| Pallet       | W | V | T | S | V | G | F | T | H | I | A | F | Q | A | J | Y | B | P | P | C | D | M | E | Z | B | E | S | N | D | P |
| Palletizing  | Y | Y | I | H | M | I | R | G | E | O | K | H | E | K | T | I | E | F | Z | P | E | T | P | S | Y | B | A | F | B | G |
| Picker       | S | D | Z | A | L | C | O | X | Y | R | A | W | T | G | D | T | M | V | H | A | O | A | P | E | O | K | I | D | K | R |
| Robotics     | E | E | I | N | V | V | M | J | F | V | L | B | Z | F | D | C | E | C | N | T | Y | D | G | K | L | J | Q | N | L | O |
| Rollers      | R | H | N | E | M | G | H | Y | R | U | Y | H | V | O | L | X | U | B | U | O | N | R | D | P | Y | I | Y | G | Y | O |
| Shelf        | E | S | G | X | K | Z | S | S | H | G | P | D | C | R | A | I | S | W | D | M | C | J | F | S | O | H | K | Q | E | Y |
| Sorter       | K | V | P | F | S | D | D | H | C | I | Z | Z | B | K | A | S | E | L | R | O | D | X | S | I | R | T | O | N | F | H |
| Sprocket     | C | C | K | J | W | L | J | T | B | T | I | U | K | L | Q | A | J | E | A | T | D | L | J | A | W | Y | C | W | S | C |
| Thermography | I | X | S | L | Z | K | L | Z | G | C | H | C | J | I | I | I | H | T | U | J | E | X | L | J | A | J | K | W | L | E |
| Tote         | P | J | E | T | A | L | C | W | I | W | A | E | C | F | J | W | W | U | G | S | A | K | L | C | Q | M | F | N | T | Q |
| Tugs         | F | N | P | M | R | D | D | G | U | K | A | R | R | T | I | J | D | H | C | W | R | J | C | H | I | A | P | N | A | M |
|              | N | G | Z | Q | B | E | G | A | K | L | T | D | O | M | N | X | H | C | N | G | D | E | Z | O | D | I | P | O | K | A |
|              | A | U | K | M | L | M | Q | D | P | T | E | N | R | U | O | B | U | U | E | T | J | P | L | X | R | E | B | J | E | B |
|              | M | B | I | G | Z | Z | W | S | Q | A | J | M | G | I | S | G | J | T | R | C | G | G | B | L | M | P | X | Q | M | A |
|              | B | R | K | S | U | W | Q | K | R | R | L | F | T | E | V | E | R | G | E | H | B | I | S | R | O | I | S | P | K | S |
|              | C | I | D | S | T | F | I | L | Q | T | S | L | E | J | I | E | L | A | C | X | O | F | G | V | T | R | R | D | B | W |
|              | X | Q | O | Z | Z | O | R | Y | U | M | J | L | E | R | I | L | R | I | P | B | D | L | Q | C | P | K | Z | U | X | I |
|              | P | H | W | G | I | L | P | I | Z | S | O | Y | U | T | M | T | X | C | H | H | K | E | T | J | L | B | Z | K | T | V |
|              | E | L | G | E | Y | R | J | R | Z | F | B | O | I | D | L | V | W | Q | X | R | Y | H | P | R | F | N | R | M | B | M |
|              | X | T | Z | H | G | Y | G | D | Y | T | Z | Z | H | L | D | Q | Q | C | N | C | U | S | A | Y | X | X | N | O | B | U |
|              | L | B | I | H | U | Y | O | N | B | T | E | J | S | V | I | N | Z | F | O | G | V | C | Q | N | K | I | Z | R | Q | C |

Done

### Screwdriver Drive Types



Hex

Torx



Torx



Pozidrive

Hex

Square



Square



Slotted

Pozidrive

Phillips (Star)



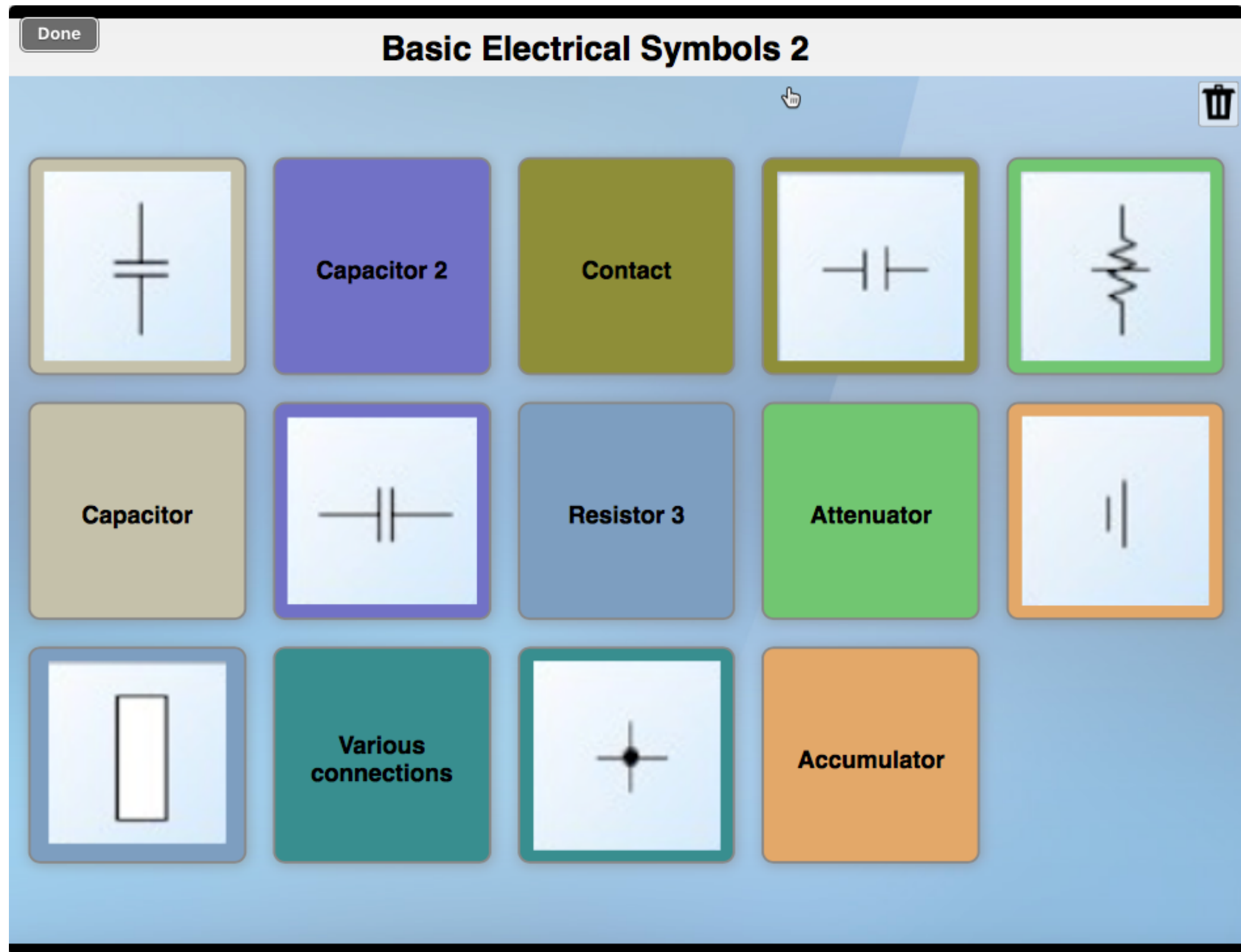
Phillips (Star)

Slotted

Done

Basic Electrical Symbols 1

|      |            |                |         |         |
|------|------------|----------------|---------|---------|
|      |            | Resistor       |         |         |
|      | Resistor 2 | Ground         | Battery | Chassis |
| Cell |            | Equi-potential |         |         |

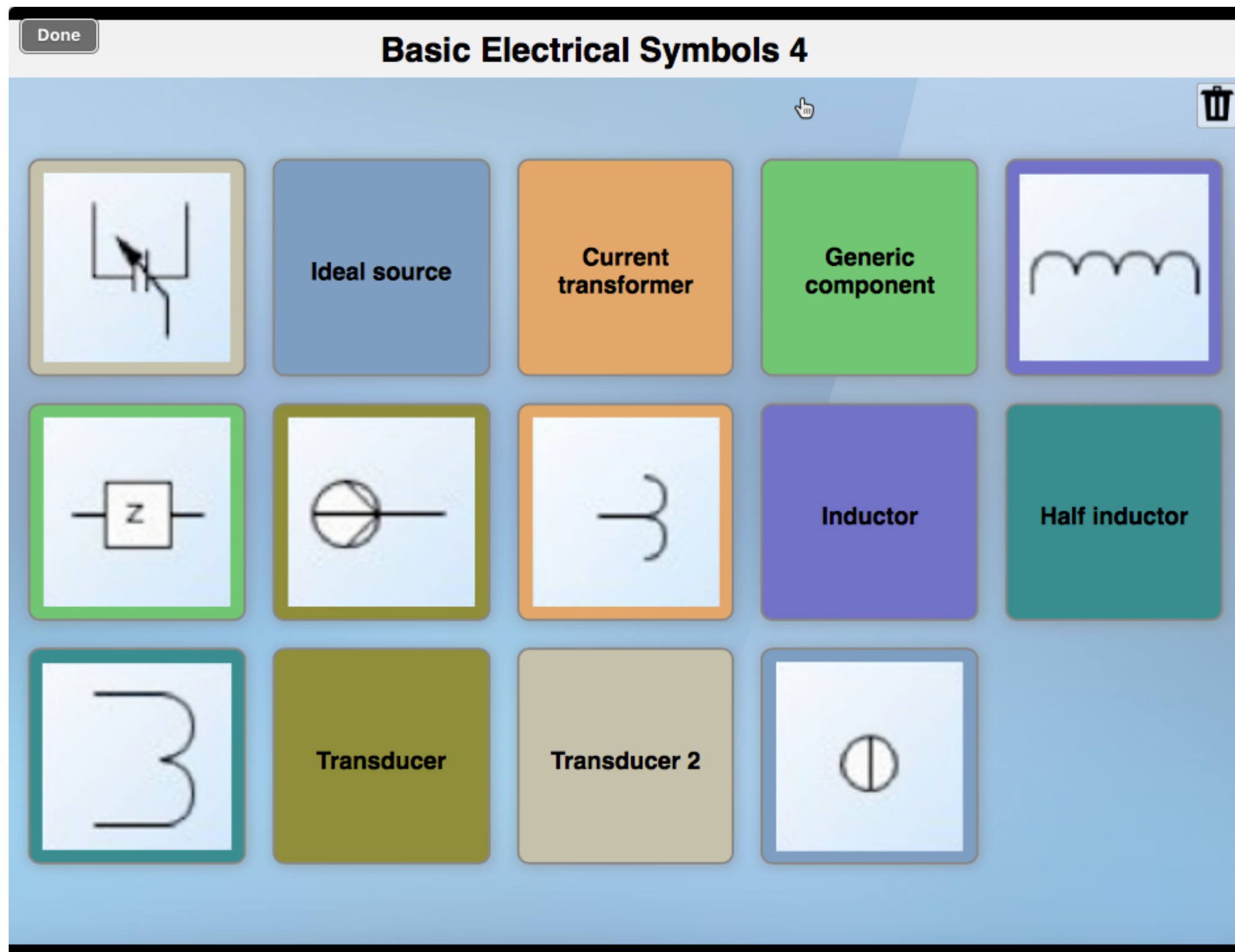


Done

### Basic Electrical Symbols 3

|         |              |         |                 |      |
|---------|--------------|---------|-----------------|------|
| Antenna |              | Crystal |                 | Fuse |
|         | Fuse 3       |         |                 |      |
| Fuse 2  | Loop antenna |         | Circuit breaker |      |





Done

## Understanding Body Signals



Loud sighs

Raised eyebrows

Standing with arms folded

"stay away"; "I dare you to approach me, uninterested, argumentative"

"Yea, right!"; "sure thing"

Tapping foot, hand, or pencil/pen

"Oh brother!"; "really"

"I can't believe you asked that question!"; disgust; "are you kidding me"

"hurry up"; impatience, I have to be someplace else

Rolling of eyes

## Review 13.3 Solutions

1. We're out of that brand.  
**We carry a different brand that you might find more attractive.**
2. The manufacturer doesn't make that model any longer.  
**That manufacturer has produced a new model that has improved features.**
3. We don't carry that type.  
**We can order that type for you.**
4. I can't ship you that many because we only have two in stock.  
**We will ship these items to you as soon as our warehouse receives its new delivery.**
5. Your part won't be here until next week.  
**A minor delay will make your part available in 5-10 working days.**

## Review 13.4 Solutions

1. When a customer calls and asks for a person who's not in today, you say:
  - a. "He's not in. I'll transfer you to his voice mail."
  - b. **"I'm sorry, he won't be in until tomorrow. Is there something I can help with or would you rather leave a message on his voice mail?"**
2. When customers reach you only after going through a long automated menu sequence, you usually can assume that:
  - a. They're irritated and impatient by how long it took to reach someone who could help.
  - b. **They're used to automated systems and set aside enough time for calls that involve them.**
3. When you really can't help and must transfer someone, you say:
  - a. "You have to talk with someone else. Hang on, I'll transfer you."
  - b. **"Sally Stone is the best person to handle that. Her extension is 999. Is it all right if I transfer you?"**
4. When you transfer a customer, you tell the person you're transferring:
  - a. **"I'm transferring Mr. Fox, a new customer, to you. He may want to add flood insurance to his homeowner's policy."**
  - b. "I'm transferring a customer to you."
5. When a customer asks a question you'll have to research, you say:
  - a. "It will take me a while to find that out, so hold on, please."
  - b. **"I'll be happy to research that for you. It will take a while, so may I call you back by 4 p.m. this afternoon?"**
6. When a customer's call is transferred to you, you say:
  - a. "This is Lily Lincoln. How may I help you?"
  - b. **"This is Lily Lincoln, Ms. Block. We appreciate your patience. Now, I understand you want some information on..."**
7. When you need to consult with your supervisor before you can answer a customer's question, you say:
  - a. **"I want to be sure I'm giving you the full information. Would you mind waiting for about two minutes while I check?"**
  - b. "I have to check that I'm giving you the full information. Hold just a minute, will you?"
8. Checking back every 30 to 60 seconds with a customer who's on hold:
  - a. Forces the person to wait even longer.
  - b. **Makes the customer feel you're on top of the situation and aware that he/she is still waiting.**
9. When a customer has accepted your offer to call back, you:
  - a. **Set a time to call back and do so.**
  - b. Get back to the customer when you have time.
10. When you're ready to resume your conversation with a customer you've put on hold, you say:
  - a. **"Thank you for holding, Mr. Carr. I've got that information now."**
  - b. "I'm back, Mr. Carr, and I have that information."

## Review 13.5 Solutions

| DON'T                                                                                          | DO                                                                                                                  |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Send emails using excessive CAPITAL LETTERS OR EXCLAMATION MARKS!!!!!!!                        | Not ever use sarcasm or joking phrases in emails. What is funny or sarcastic to you may not be to others.           |
| Send extremely urgent requests via email alone.                                                | Always attempt to introduce yourself on a phone call or in person wherever possible.                                |
| Send personal emails such as jokes or chain letters to co-workers or customers.                | Not leave off important information such as your full name and phone number.                                        |
| Send emails without proofreading first.                                                        | Use the out-of-office instant reply when you're out of the office for a day or more.                                |
| Forget to use the out-of-office instant reply when you're out of the office for a day or more. | Follow up urgent messages with a telephone call.                                                                    |
| Send lengthy, detailed instructions that could be confusing to the reader.                     | Not send personal emails such as jokes or chain letters to co-workers or customers.                                 |
| Leave off important information such as your full name and phone number.                       | Always proofread your messages for errors.                                                                          |
| Leave emails unread & out of order.                                                            | Use proper grammar to clearly articulate your message without exaggerating.                                         |
| Introduce yourself for the first time via email.                                               | Read and follow up with your emails in a timely manner. Keep them organized so you can find them in the future.     |
| Use sarcasm or joking phrases in emails.                                                       | Send clearly articulated instructions that are concise to the reader. Complex directions should be given in person. |



## Review 13.6 Solutions

### Across:

- 2. Internal**—this type of customer service takes place between departments in a single company.
- 3. Incident**—these reports will document injuries or hazardous waste spills; you must ensure the forms required by your department, organization and/or oversight agency are filled out completely and properly
- 4. External**—this type of customer service takes place between a company representative and outside individuals or companies.
- 5. Nonverbal**—this communication is done without speaking a word during face-to-face communications.
- 7. Complaint**—RO statement that needs to include all the relevant information to allow the technician to narrow down and diagnose the equipment quickly.
- 10. Cause**-- completed only by the supply chain technician and allows a place for the technician to document on the RO what exactly has occurred to produce the equipment failure.

### Down:

- 1. Recommendation**— term used when part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.
- 6. Required**—term used on a repair order when part does not meet a design specification (regardless of performance) or part is missing.
- 8. Remedy**-- a place where the supply chain technician records the action completed on the piece of equipment.
- 9. Active**—type of listening that requires you to understand what is being communicated from the speaker's point of view and it requires you as the listener to: concentrate on what is being said by the speaker and tune out the hundreds, if not potentially thousands, of distracting thoughts.

# Selected Useful Websites

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## Selected Useful Websites and Suggested Readings

*The following are a sample of sites which may be of interest to students or useful in understanding concepts and completing written assignments.*

<http://www.supplychainautomation.com>

National Center for Supply Chain Automation site with information about all aspects of technician education and the industry

Other Sites of Interest:

<http://indiawarehousingshow.com/>

Overview of 7<sup>th</sup> Annual India Warehouse Show

<http://www.mhi.org/> Material Handling Industry, Professional Organization site

<http://videos.mhi.org/home> Note: Other free publications and videos as well as access to *MHI Solutions* available through site

<http://www.mhi.org/cicmhe/resources> The site also links to College Industry Council on Material Handling Education with many resources.

<https://www.mhi.org/publications/report> The 2017 MHI Annual Industry Report Next-Generation Supply Chains: Digital, On-Demand and Always-On

<http://www.msscusa.org> Certification Information

<https://awl2016.mit.edu/> [Workshop on Automation for Warehouse Logistics](#)

Massachusetts Institute of Technology website for automated warehouse technology with links to videos and presentations from 2016 Amazon Picking Challenge

<https://www.rhsmith.umd.edu/faculty-research/academic-departments/logistics-business-public-policy/research/professional>

University of Maryland “Professional Organizations and Associations and Supply Chain/Logistics Industry Associations” list

### **Selected Trade Periodicals:**

*3PL News* <http://www.3plnews.com>

*MHI Solutions* <http://www.mhisolutionsmag.com/>

*Modern Materials Handling* <http://www.mmh.com/topic/category/automation>

*Supply Chain Digital*  
<http://www.supplychaindigital.com/magazine>

### **Selected Articles**

“2017 Technology Roundtable: Tips & Technologies to Create a More ‘Intelligent’ Logistics Operation” 18 May 2017

<http://www.logisticsmgmt.com/article/2017-technology-roundtable-are-we-closer-to-intelligent-logistics>

“How Warehouse Automation Saves Space and Improves Your Supply Chain” 9 March 2016

<http://www.3plnews.com/3pl/how-warehouse-automation-saves-space-and-improves-your-supply-chain.html>

Knight, Will. “Amazon Robot Contest May Accelerate Warehouse Automation” 25 March 2015

<https://www.technologyreview.com/s/536086/amazon-robot-contest-may-accelerate-warehouse-automation/>

Pierce, Freddie. “Ten Reasons You Should Consider a Career in Logistics” 30 Aug. 2012

<http://www.supplychaindigital.com/top-10/ten-reasons-you-should-consider-career-logistics?q=ntr>

Pierce, Freddie. “The Top 10 Automated Warehouses” 07 March 2011

<http://www.supplychaindigital.com/warehousing/top-10-automated-warehouses>

### Examples of Manufacturers' Websites

**NOTE:** *These listings are provided solely as a few examples of manufacturer's websites offering equipment similar to that with which a technician may be working. Their presence on this list is NOT any endorsement of products, services or quality. These sites were selected only because of the information contained on the site and their representativeness of other similar sites.*

<https://www.raymondcorp.com/automation>

Manufacturer's web site: Raymond Corporation

<http://www.ssi-schaefer.us/automated-systems.html>

Manufacturer's web site: SSI Schaefer Systems International, Inc.

<https://www.westfaliausa.com/products/automated-storage-retrieval-systems>

Manufacturer's web site: Westfalia Technologies, Inc.