Corrosion Technology

Information Exchange

Powered Communication Equipment
for
Corrosion Control Applications

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Powered Communication Equipment - Is it in your Toolbox?

Every day each of us use tools to help us do our work. Whether it's a wrench, a paintbrush or a pen, we rely on the *tools* of our particular trade to complete our work tasks in the most efficient and productive manner possible. Different operations have totally different operational and equipment requirements and what works for one job may not work as well for another. The right tool for the right job will always save time and money. In the following article, I will discuss portable communication equipment as a "tool" for corrosion control operations.

The Right Tool for the Job

Just like you wouldn't use a hammer to turn a screw or a grinder to apply paint, you need to select the right communication equipment for the job. Choosing powered communication equipment can actually be very simple and in some cases easier than choosing a cutter or the right tip for a torch.

Portable communication equipment when all is said and done falls into two basic categories or technologies, namely "Wired" and "Wireless". Each has their own strengths and weakness depending on where and how they are used and while some systems are more complicated than others, I intend to limit this discussion to powered portable communication equipment used by workers themselves in their environment.

In selecting a tool, you first look at the work environment and the task to be done before deciding which tool is appropriate. Only then do you select it. Any consideration to utilize portable communication equipment must begin in exactly the same way. First look at the most basic solutions, normal speech or hand signals, and see how they function in the work environment you are assessing. If these methods are not practical but communication is needed to increase the safety or efficiency of personnel on the job, then a powered communication option may be the answer and should be explored.

In order to select the right communication tool, it is essential that we have a basic understanding of the two different types of communication equipment available and which work environment each is best suited for. Armed with this knowledge we can easily assess which method of communication would be appropriate to make the job we are about to do easier, safer and more efficient.

Portable Radios

Probably the most common piece of communication equipment used in a plant or shipyard is a portable two-way radio. The obvious benefit of any radio system is that there is no connecting cable and they can accommodate an unlimited number of users. In addition, radios are available with many options and accessories, which makes communication possible with a wide variety of personal protective equipment. Portable radios are typically lightweight and use rechargeable batteries. Other desirable features include prioritized channels, programmable frequencies and intrinsic safe approvals. Radio equipment functions best when it is out in the open, in line of sight of a radio antenna or repeater. It can also perform well in areas that have openings allowing signals to "bounce" to or from another radio or repeater, etc. Operations requiring users to have freedom of movement or those that are carried out in the open are best suited to radio equipment.

Some of the negative aspects of radio equipment may not be readily apparent. For instance, radio equipment does not function reliably in enclosed spaces constructed of metal or using stealth technology for example, aircraft fuel cells, shipboard void spaces, water tanks, fuel tanks, towers, vessels, etc. In these work environments, radio communication is unreliable and subject to dead spots, fading and weak signals, similar to what happens to car radios when driving through an underground parking lot or tunnel. In addition, radios and cellular phones can be extremely hazardous in and around fuel tanks and explosive ordinance due primarily to Effective Isotropic Radiated Power (EIRP). For example: Boeing recommends its customers observe a minimum separation distance from open aircraft fuel tanks of 50 feet for

radios transmitting less than 100 watts (i.e. portable radios, radar, cellular phones, etc.). (Reference Boeing Service Letter Dated 30 April 1996 - Item 19)

Another aspect of portable radio equipment commonly overlooked is fact that radio transmissions are subject to unwanted or outside monitoring and/or interruption. During operations of a sensitive nature such as a rescue or during work inside classified areas, it is important to be aware that transmissions can be monitored. As a final note, portable radios are subject to considerable abuse in the work place and maintenance costs can be high and should be factored into the decision process.

Portable Radio Accessories

Portable radios typically operate on a “Push-To-Talk” basis, requiring workers to stop what they are doing or take their hands off what they are doing in order to communicate. Radio accessories are available that incorporate large body worn Push-To-Talk switches or remote finger switches so that users do not have to actually activate the PTT on the side of the radio.

To address the PTT issue some radio users have turned to “hands-free" or “voice activated”(VOX) radio accessories. These accessories work best in Low to Medium noise environments. In High noise areas VOX accessories are plagued by false activation due to high ambient noise picked up by the microphone. High noise triggers the *electronic* Push-To-Talk switch and can inadvertently lock a radio into transmit mode cutting off all communication on a particular channel. VOX radio accessories typically have a PTT override in addition to some kind of microphone sensitivity adjustment to accommodate different ambient noise levels. Difficulties arise when workers move from low to high noise locations (or visa versa) and do not re-adjust the microphone sensitivity. Also in cases where users position the radio equipment inside their protective clothing (i.e. encapsulated suit) the adjustment becomes difficult if not impossible to reach. In this writer's opinion, a good rule of thumb is to use only PTT activation for radio accessories in extremely dangerous environments. This helps to prevent any accidental lock out of your communication system due to ambient noise levels or if someone gets hurt and is screaming in pain.

One of the most common problems for radio users is how to effectively communicate over a portable radio when wearing a facemask respirator or breathing apparatus. Many different accessories are available and include; Throat Microphones, Bone Conduction Microphones, Integrated Mask Microphones, Ear Microphones that work in conjunction with a variety of speaker or earphone options for listening. All of these accessories have their own positives and negatives that must be assessed in terms of a particular work environment or task. When assessing radio accessory equipment look for flexibility or adaptability in the equipment design to get the best value for your dollar. Some questions you might ask include; Can I use the accessory with or without a facemask? How does the equipment function in a high noise environment? Does the equipment require Batteries? How many? What type? Is the equipment Waterproof? Is the equipment Spark Proof, Intrinsically Safe or Explosion Proof? Is the product Voice Activated? Push-To-Talk? Both? How big is the PTT Switch? What options are available? What is the warranty period? And last but not least, how much does it cost?

Hardwired Communication Equipment

Portable hardwired communication systems are not as common as two-way radios but are growing in popularity for work in and around Confined Space, Gas Free, Explosive Ordinance, and Sensitive applications. At first glance, the biggest drawback to this method of communication is the cable itself. That said, the cable is also one of this equipment's greatest assets as hardwired systems typically excel in areas where radios fail. Aircraft fuel cells and underground storage tanks are good examples of areas where radios become unreliable due to the shielding effect of the surrounding metal or composites. Workers in these environments can benefit greatly through the use of a hardwired communication system. The continuous communication that is offered by this type of equipment allows the monitoring of entrants by a safety attendant as required by OSHA and AFOSH, NAVOSH Confined Space entry safety requirements. Passing signals through a correctly shielded cable facilitates communication without the worry of interference, dead spots, or the radiation of potentially dangerous or destructive radio signals. Portable hardwired systems provide two-way communication between all users entrants and attendants. Full duplex systems are completely hands-free and provide a dedicated and private network for workers doing a specific job. During jobs where supplied air breathing apparatus is required, the communication cable can be "piggybacked" onto a breathing air line, making a single umbilical, that is easily managed by the entrant. Accessories for portable hardwired systems include pass through connectors for chemical suits, face mask communication accessories, high noise headsets, alarm options, and talk boxes. The units are typically battery powered and able to deploy anywhere that work must be done. Systems are available with high level Intrinsic Safe Approvals for use in explosive environments.

Negative aspects of a portable, hardwired communication system are: the number of users per operation, physical attachment by cable and distance limitations. It is important to note that *sound powered* phones are not the same as a powered hardwired communication system. This is a common mistake, but the differences make comparison almost impossible. The sound powered phone systems are temperamental, cumbersome, and the volume and clarity is inadequate for confined space entry/gas free operations. Current sound powered phone headsets do not couple with standard breathing equipment and require one hand to operate and provide no means of emergency alarm notification.

Safe Equipment

When selecting <u>any</u> electrically powered communication equipment destined for use in a hazardous or potentially hazardous environment, it is important to choose equipment that has been designed and approved to be spark proof, explosion proof or intrinsically safe. To do this properly you must have an understanding of the classification for hazardous locations set out in the National Electrical Code (NFPA 70). Follows is an abbreviated list of the different classifications and what they mean. If there is any doubt about the approval rating on a particular piece of equipment…"Check the Label". In North America, all intrinsically safe or explosion proof equipment has to carry a label that lists the hazardous location or hazardous locations, for which it has been tested and approved. Simply put, if it doesn't say it on the label, it's not approved for that location and if there is no label, the equipment is not approved. In instances where physical size prohibits a listing of approved locations, the equipment will have, as a minimum requirement, the mark of the Nationally Recognized Test Laboratory (NRTL) who did the testing. If there is any question about the approval status for a piece of electrical equipment, request a copy of the certification record or approval agreement from the equipment manufacturer or distributor and keep it on file for future reference.

National Electrical Code (NEC) classifications for hazardous locations.

Class I

Locations where there is a danger of explosion due to flammable Gases or vapours present in quantities sufficient to produce explosive or ignitable mixtures.

Class II

Locations where there is a danger of explosion due to the presence of combustible or electrically conductive dust.

Class III

Locations where there is a danger of explosion or flash fire due to the presence of easily ignitable fibres or flyings.

Classes are separated into Divisions 1 & 2

Div I Locations where the gases, vapours, conductive dust, combustible dust, flyings and/or fibres are present in the air in potentially flammable concentrations continuously, frequently or intermittently under normal operating conditions.

Div II Locations where the gases, vapors, conductive dust, combustible dust, flyings and/or fibres might become hazardous in the event of mechanical breakdown, accident, failure or the abnormal operation or equipment.

The Classes are further divided into Groups;

Class I

Group A Acetylene
Group B Butadiene, Hydrogen, Ethylene Oxide, Propylene Oxide & Acrolien
Group C Acetaldehyde, Ethylene, Ether Vapours,
Group D Acetone, Ammonia, Benzene, Butane, Cyclopropane, Gasoline, Hexane, Methane, Methanol, Natural Gas, Naptha, Propane,

Class II

Group E Combustible metal dust including Aluminium, Magnesium and their Commercial Alloys
Group F Combustible carbonaceous dusts including Carbon Black, Coal, Charcoal,
Group G Combustible dusts not listed in groups E or F including Flour, Grain, Wood, Plastic

Class III

No Groups

Note: Refer to the National Electrical Code Articles 500,501,502,503, 505 for a complete description of Hazardous Area Classifications and Group descriptions including an alternative hazardous location identification scheme (Zone Classification System)

Assessment

Like the selection of any new tool, communication equipment must be correctly assessed to meet the needs of the job. A requirement for communication equipment for a particular application must be looked at from a global perspective and is best done with the input and comment from the people that actually do the work. In many instances the intended procedures and processes for a particular application differ greatly in practice, go to the source, you may be surprised what you find out.

A work assessment should include; The task itself, number of workers and their roles, work environment, equipment and tools used, current method of communication and any drawbacks, benefits of improved communication, safety concerns, actual equipment requirements.

Considerations such as: the work environment; location; equipment used by workers i.e. respiratory or protective equipment etc.; or any other factors that hinder communication. Work place noise (continuous or sporadic). What types of tools or equipment are being used to conduct the work. Selection criteria for communication equipment destined for use in work place applications requires the equipment technology to function reliably within the work environment.

The following is an example of an actual equipment selection and some of the issues that were dealt with during the selection process.

EXAMPLE

Task: Ballast Tank Entry for cleaning & painting

Number of Workers: 1 Safety Attendant, 2-4 worker/entrants

Work Environment:

- Steel Enclosed Space
- Restricted Entry and Exit
- High Noise Area
- Water, Debris
- Chemicals, Vapors
- Potential oxygen deficient, explosive or hazardous atmosphere.

Equipment used during the operation:

- Supplied Air Breathing Apparatus
- Protective Equipment (clothing, gloves, hearing protection, glasses, hardhats, etc.)
- Atmospheric monitoring equipment
- Retrieval/fall protection equipment (depending on the space)
- Ventilation equipment
- Sand Blasting equipment
- Spray Painting equipment
- Explosion Proof Lighting

Current method of communication:

- Exiting the space to verbally communicate with personnel *outside* the space.
- Communication using hand signals or shouting between personnel working *inside* the space.

Drawbacks to Current Method of Communication:

- Must stop work to communicate resulting in decreased efficiency and lower productivity.
- Mistakes are made due to misunderstandings.
- Cannot make visual contact during Blasting Operations
- Does not measure up to the intent of the safety regulations for Gas Free/Confined Space Entry.

Benefits of Improved Communication:

- Workers would not have to stop work to communicate with the outside.
- If workers need something, they just ask for it increasing efficiency and productivity.
- Communication between workers will make the attendant/observer a useful member of the team.
- He/she can enter data into a computer or fill in inspection sheets while the entrant calls out findings.
- Complies with current safety regulations.
- Attendant maintains continuous hands-free two-way communication with entrant(s).
- Single attendant could monitor multiple entrants.
- Workers could talk to each other and co-ordinate operations even in high noise environments.
- Does away with misunderstandings due to complicated hand signals, etc.

Safety Concerns:

- Must comply with Confined Space/Gas Free safety regulations and protocols.
- Intrinsically Safe / Spark Proof or Explosive Proof equipment

Criteria for a Ballast Tank Communication System:

- A Hardwired Communication System that will function reliably in a heavily shielded enclosed steel space.

- A fully open system that allows for hands-free operation.

- The equipment must be Spark Free (Intrinsically Safe) and third party certified by a Nationally Recognized Test Laboratory for Compliance with National Electrical Code and NAVOSH & OSHA regulations.

- Interchangeable accessories to allow for a variety of different spaces and applications.

- The user communication accessories that interface with the system will perform well in High Noise environments and must function with or without a face mask.

- The system will be battery powered, portable and waterproof.

- The hardwire should be shielded against Electro magnetic and radio frequency interference.

- The unit will not emit a signal that could affect the readings of atmospheric monitoring equipment.

- The construction of the equipment should be such that it will withstand harsh work environments and rough handling by users.

- The communication cable must be flexible, resistant to chemicals, lightweight and rugged.

Conclusion

Probably the best advice when considering communication equipment of any kind is to take a common sense approach and try it yourself. Communication equipment manufacturers and their local representatives spend a lot of time and money on product training and demonstration equipment, to address the needs of users in the field. They are a good starting point, many communication professionals if not able to help solve your specific problem themselves are *"in the business"* and may know of someone or something that can.

These days, because of economic realities it is more important than ever for organizations to work smarter and use resources more effectively. Doing more with less is a dilemma that faces Commanding Officers, Managers, Foremen and Crew Chiefs on a daily basis. Communication equipment when correctly selected and applied can help to solve this problem and can produce real results by increasing productivity, efficiency, and safety. Saving both Time and Money.

Communication - Is It In ***Your*** Tool Box?

Author's Note:
I recognize that radio types, styles and manufacturers are varied and that more elaborate radio systems can overcome some of the difficulties listed above. However, for the purposes of this paper I have limited comments to common, simplex portable radio systems and accessories widely used in both the fire service and industry. The information and opinions expressed herein are those of the author. It has been written without prejudice or copyright, and may be copied and/or distributed as required.

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Typical Equipment Pictures

Motorola HT - 1000 Portable Radio

Ericsson - MRK Portable Radio

CON-SPACE Hardwire Communication System