REFRIGERATION & AIR CONDITIONING

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Musculoskeletal disorders (MSDs), such as chronic back pain or shoulder problems, often take time to develop. Forceful exertion, awkward positions, hand-arm and whole-body vibration, contact stress, and repetitive tasks can add up over time to produce an MSD.

This profile can help you identify and control MSD hazards in your job. We recommend that you add the best practices outlined here to your company's health and safety program. The hazards in a particular job, however, may be different than the ones on this profile, so evaluate the risks of your particular activities.

In general, when implementing controls, consider the following ergonomic principles:

1. ***Use handling equipment when possible.*** The most effective intervention to control the risk of developing an MSD is to eliminate or reduce the frequency of lifting, carrying, pushing, and pulling. Use material-handling equipment such as carts, dollies, pallet jacks, or manual forklifts.

2. ***Don't lift a load from the floor.*** Lifting from the floor or below standing knuckle height can expose your back to significant stresses and reduce your lifting capacity. Avoid this procedure by storing objects above standing knuckle height and below standing shoulder height.

3. ***Avoid working on the floor.*** Constantly working on the floor can result in injuries to your back, hips, and knees because it usually requires kneeling and bending your back forward. When possible, raise the work height by using a workbench.

4. ***Minimize work above your shoulder.*** High lifting or constant reaching above the shoulder level is harmful for three reasons.
   1. Your muscle strength is reduced because most of the muscle work is performed by your shoulders and arms instead of by the bigger muscles in your back and legs.
   2. Your shoulder and arm muscles fatigue more quickly than your back and leg muscles because of reduced blood flow.
   3. Lifting or removing an object from a high shelf can be dangerous because you could drop the object.

5. ***Move smaller weights often or get help.*** Smaller weights put less stress on your back than larger weights, even if the frequency of lifting is increased.

6. ***Exercise programs.*** Consider exercise programs. They help to prevent MSDs and promote general good health.

Air-cooling, air-conditioning, heating, and ventilating systems

Tasks	What can happen (Hazards/Risks)	Potential Controls
▶ Selects, cuts, transports, and installs pipes ▶ Transports equipment to the jobsite. ▶ Installs refrigeration and air-cooling systems ▶ Installs heating, ventilating, and air-conditioning systems	▶ Overexertion injuries due to • lifting and carrying pipes • pushing/pulling carts with heavy pipes • transporting heavy equipment • handling ladders ▶ Static bending at the waist, kneeling, and squatting while installing and cutting materials ▶ Stress on the knees, shoulders, and arms due to kneeling, carrying large objects, and working with hand tools	▶ Actively assess the job and implement controls before starting work to avoid overexertion and awkward postures. ▶ Plan ahead to minimize material handling. ▶ Get help from another worker if one piece of material is greater than what the worker can safely handle. Consider the weight of the item, lifting location, and your posture. ▶ Use portable mechanical lifting equipment whenever you can, particularly when loading or unloading heavy materials. Suitable material-handling equipment may include a Genie lift, a light mobile overhead crane, or powered buggies. ▶ Become familiar with the many types of hoists, balancers, and attachments that are available to assist in lifting objects. Always ensure that the equipment is capable of handling the weight of your load. ▶ Most hand trucks and carts are often available in several shapes and sizes. Some can be customized for special applications. Investigate through your purchasing department or talk to your supervisor to get the correct handling equipment for your needs. ▶ Consider storing all materials in large containers. This will reduce material handling and improve efficiency because large quantities of material (e.g., cables, welding units, hoses, rigging equipment) can be transported at one time using a forklift or crane. ▶ When using carts or hand trucks: • Select models with appropriate wheels for the ground conditions. • Select models with swivel wheels on the rear and fixed wheels on the front to make it easier to push over longer distances. • Maintain the wheels in good condition. • Make sure handles are located at the rear of the cart and at waist level. • Make sure the load height on the cart does not obstruct your vision. • Keep the loads balanced and under the manufacturers' recommended weight limits.

Tasks	What can happen (Hazards/Risks)	Potential Controls
		▶ Push rather than pull because pushing reduces low-back bone-on-bone compression. ▶ Whenever possible, use overhead crane devices to lift and transport heavy items. When installing an overhead crane on site, ensure that the system or device is rated for the weight of your load. Consider the movement patterns before installing the crane. ▶ Use motorized pallet jacks when moving material frequently or over long distances. ▶ Attach pulley systems to tools or equipment. This reduces the force needed to lift, position, or operate the tools or equipment. ▶ Implement a shelving system that can store and move materials, tools, or equipment. They can position work material within easy reach and allow you to lift or move objects without bending or twisting. If you use rack systems, store items between knee and shoulder height whenever possible. ▶ Store equipment and objects above ground level whenever possible, so that you are lifting from between chest and knee height. ▶ Use a ramp, either aluminum or wood planks, to allow you to easily handle objects on stairs and uneven walkways. ▶ Use lift tongs with handles to assist with handling propane and related equipment. ▶ Use teamwork when mechanical aids are not available. ▶ Make your work easier by working in comfortable postures. Create a stable workbench that allows you to work while standing upright with your arms close to your sides. ▶ Keep cutting tools sharp to reduce the force required to use them. ▶ If you do a lot of cutting, use a power saw. ▶ Use shoulder pads when you are lifting a heavy item that cannot be transported with a cart or other transport device. Carrying heavy objects on your shoulder often applies excessive pressure on a small area. Wearing shoulder pads can reduce the stress on your shoulder.

Tasks	What can happen (Hazards/Risks)	Potential Controls
		▶ Move close to your work and centre yourself to the work area to reduce overreaching or bending at the waist. ▶ If available, use a scissor lift or other work platform. ▶ Use a lightweight tool whenever possible. ▶ To reduce working above shoulder height, consider using a tool that has extended arms or handles to prevent you from having to keep your arms raised. ▶ Select the right tool. Choose tools that fit your hand comfortably. Whenever possible, use power tools or tools that require less force. ▶ Let your supervisor know if you need training on a new tool or process. ▶ Practice good housekeeping. Discard or pick up debris and scrap material to prevent repetitive bending, slips, trips, and falls. Keep pathways clear for carts, wheelbarrows, and dollies. This will reduce forceful exertion when moving equipment. ▶ Wear gloves with anti-vibration properties. These gloves can reduce the vibration that is transmitted to your hands and arms from tools such as grinders, needle guns, and sanders. ▶ Use elbow pads to protect your elbows. Elbow pads are useful when you are working in cramped spaces and/or leaning on your elbows. Elbow pads should fit snugly, but should not compromise circulation in your arm. ▶ Use proper lifting techniques (lift materials with your legs and back, do not bend over, and keep the load close to your body). See the "Back Care" chapter in IHSA's *Construction Health and Safety Manual*. ▶ Consider a 3-point lift method when handling heavy or long material by yourself: 1) squat and lift on one end, 2) walk up the load, and 3) lift the object.

Tasks	What can happen (Hazards/Risks)	Potential Controls
▶ Welding steel pipes	▶ Awkward postures such as squatting, kneeling, or stooping due to the confined or tight locations ▶ Lifting heavy equipment or materials ▶ Holding a bent-neck position or keeping your shoulders raised for a long time ▶ Supporting the weight of your hard hat and welding mask with your neck	▶ Change work positions often. Working overhead or in cramped spaces forces the body into awkward postures. To relieve muscle tension and improve circulation, change body positions, alternate tasks, and stretch throughout the day. ▶ Use auto-darkening lenses on your welding helmet. They darken as soon as the arc is struck, which eliminates the need to repeatedly open and close your helmet using your neck. The lenses will reduce neck strain. ▶ Choose welding sets that have comfortable, well-positioned handles. Protruding controls or vents can make the welding set more difficult to carry. When choosing a large welding set, choose one that you can push or pull comfortably over uneven surfaces. ▶ Put your welding leads on pulleys. ▶ Use welding guns that have swivels and can be used in either hand. ▶ Pre-assemble material and use material-handling equipment to reduce unnecessary lifting. ▶ Use wheel accessories when moving a pipe-threading machine. ▶ When possible, use equipment such as forklifts, power buggies, or power carts to transport pipes. ▶ Cut pipes on a bench, whenever possible, to reduce awkward bending. ▶ Rent or purchase lightweight hand tools that do not vibrate very much. You should also look for tools that have low kickback and torque reduction. ▶ Use tools with handles that are comfortable and provide a good grip, such as rubber or spongy-type grips. Make sure grips are designed to be used by either hand. ▶ Select hand tools that are designed for a neutral wrist posture and that reduce the amount of force applied. ▶ Ensure that there is an adequate power supply for power tools and that the tools are properly maintained. ▶ Rotate to other tasks when you can to give your muscles a break from doing the same thing over and over again.

Tasks	What can happen (Hazards/Risks)	Potential Controls
		▶ Be alert to avoid pinch points near your feet ▶ Take stretch breaks throughout the day to relieve discomfort and to get your muscles moving.
▶ Maintains heating, ventilating, and air conditioning systems	▶ Static bending at the waist, kneeling, and squatting while performing maintenance work ▶ Overexertion injuries of the shoulder and back due to lifting ladders on and off the roof of vehicles	▶ Install a hydraulic ladder rack to assist with loading and unloading ladders from vehicles. ▶ Use a large, thick, soft mat to reduce contact stress when kneeling and lying on the ground. ▶ Reduce the weight of the toolbox by carrying only the tools you will need for the job. ▶ If possible, use lighter, cordless electrical tools to remove or install bolts and screws. ▶ Sit on a work stool when the work is low or use a thick mat when lying on the ground. ▶ Take stretch breaks throughout the day to relieve discomfort and to get your muscles moving. ▶ Use tools and equipment that have comfortable handles whenever possible. For example, when lifting a bucket, you won't have to use as much force if the handle is thick, so add padding to the handle or use equipment with thicker handles. ▶ Install a grasp bar on top of service vans to make it easier to enter the back of the van. ▶ Install an extra step at the back of service vans to reduce the distance between the ground and the bumper of the van. ▶ Whenever possible, install an adjustable arm support for the computer to accommodate both left- and right-handed users.

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