1.0 PURPOSE

The purpose of this procedure is to outline the standard of requirements for vendors that supply Tiercon Corp.'s & Coplas Inc.'s machinery and equipment.

2.0 SCOPE

This Standard of Requirements is a supplementary document to **TCAPQP-WIN-004**. Both documents should be used in conjunction when purchasing or modifying machinery or equipment within Tiercon Corp and Coplas Inc.

3.0 DEFINITIONS

Term	Definition
Apparatus	Equipment, machine, or device.
Protective element	Shield, a guard, an operating control acting as a guard, a locking device or any other device preventing access
Spray booth	Power-ventilated structure that encloses or accommodates a spraying operation so that spray vapour and residue can be controlled and exhausted.

4.0 RESPONSIBILITY

Tiercon Project / Manufacturing Engineer

- Review this document before creating new builds to be used at Tiercon or Coplas.
- Provide this document to contractors / suppliers to serve as a guide for new builds.

Supplier

- Review this document and use it as a guide when creating new product or builds for Tiercon or Coplas.

5.0 PROCEDURE

5.1 Pre-start Health and Safety Reviews (OHSA Reg. 851 S.7)

1. An owner, lessee or employer shall ensure that a pre-start health and safety review is conducted if, in a factory, an applicable provision applies and a corresponding circumstance described in the Table will exist; O.Reg 851, s. 7 (2).
    a. because a new apparatus, structure or protective element is to be constructed, added or installed or a new process is to be used; or

b. because an existing apparatus, structure, protective element or process is to be modified and one of the following steps must be taken to obtain compliance with the applicable provision:
    i. New or modified engineering controls are used.
    ii. Other new or modified measures are used.
    iii. A combination of new, existing or modified engineering controls and other new or modified measures is used. O. Reg. 434/21, s. 1 (2).

2. A pre-start health and safety review is not required,
    a. at a logging operation; or
    b. if an exemption set out in the Table applies. O. Reg. 434/21, s. 1 (2).
3. A pre-start health and safety review shall be conducted by,
    a. an engineer for item 1, 2, 3, 4, 5, 6 or 7 of the Table; and
    b. an engineer or a person who in the opinion of the owner, lessee or employer possesses special, expert or professional knowledge or qualifications appropriate to assess any potential or actual hazards for item 8 of the Table. O. Reg. 434/21, s. 1 (2); O. Reg. 374/22, s. 2.
4. A report on the pre-start health and safety review shall,
    a. be made to the owner, lessee or employer in writing;
    b. be signed and dated by the person conducting the review;
    c. have a seal affixed to it in accordance with the requirements under the *Professional Engineers Act*, if the person conducting the review is an engineer; and
    d. include the following information:
        i. details of the measures to be taken for compliance with the applicable provisions,
        ii. if item 3 or 7 of the Table applies, details of the structural adequacy of the apparatus or structure,
        iii. if any testing is to be performed before the apparatus, structure, protective element or process can be operated or used, as the case may be, details of the measures to be taken to protect the health and safety of workers while the testing is carried out, and
        iv. if the person conducting the review is not an engineer, the person's special, expert or professional knowledge or qualifications. O. Reg. 434/21, s. 1 (2); O. Reg. 374/22, s. 2.
5. If a pre-start health and safety review is required, the owner, lessee or employer shall ensure that the apparatus, structure, protective element or process is not operated or used, as the case may be, unless the review has been conducted and,
    a. all measures identified in the review as being required for compliance with the applicable provisions have been taken; or
    b. if some or all of the measures specified in clause (a) are not taken, the owner, lessee or employer has provided written notice to the joint health and safety committee or the health and safety representative, if any, of what measures have been taken to comply with the applicable provisions. O. Reg. 434/21, s. 1 (2).

6. If a pre-start health and safety review is required, the owner, lessee or employer shall provide a copy of the written report made under subsection (5) to the joint health and safety committee or the health and safety representative, if any, before the apparatus, structure, protective element or process is operated or used, as the case may be. O. Reg. 434/21, s. 1 (2).
7. (8) The owner, lessee or employer shall keep the following documents readily accessible in the workplace for as long as the apparatus, structure or protective element remains in the workplace or the process is used in the workplace, as the case may be:
    a. A copy of a written report made under subsection (5), together with supporting documentation, if any.
    b. A copy of the documentation that establishes an exemption set out in the Table. O. Reg. 434/21, s. 1 (2).
8. If an exemption set out in the Table applies, the owner, lessee or employer shall provide a copy of the documentation described in paragraph 2 of subsection (8) to the joint health and safety committee or the health and safety representative, if any, upon request. O. Reg. 434/21, s. 1 (2).

Item	Circumstances	Applicable provisions of this Regulation	Exemptions
1.	Either of the following applies with respect to flammable liquids: 1. More than 235 litres of flammable liquids are located in a building or room. 2. Flammable liquids are dispensed in a building, room or area.	Subsections 22 (1), (2) and (4)	All of the following requirements are met: 1. No more than 235 litres of flammable liquids are stored per adequate cabinet. 2. No more than three cabinets containing flammable liquids are in a group of cabinets. 3. There is a minimum distance of 30 metres between groups of cabinets containing flammable liquids.
2.	Any of the following are used as protective elements in connection with an apparatus: 1. Safeguarding devices that signal the apparatus to stop, including but not limited to safety light curtains and screens, area scanning safeguarding	Sections 24, 25, 26, 28, 31 and 32	1. The protective element was installed at the time the apparatus was manufactured, and, i. the apparatus and the protective element were manufactured in accordance with, or have been modified to meet, current applicable

	systems, radio frequency systems and capacitance safeguarding systems, safety mat systems, two-hand control systems, two-hand tripping systems and single or multiple beam systems. 2. Barrier guards that use interlocking mechanical or electrical safeguarding devices.		standards; and ii. the apparatus has been installed in accordance with current applicable standards, if any, and the manufacturer's instructions. 2. The protective element was not installed at the time the apparatus was manufactured, and, i. the apparatus and the protective element were manufactured in accordance with, or have been modified to meet, current applicable standards; and ii. the apparatus and the protective element have been installed in accordance with current applicable standards, if any, and the manufacturer's instructions.
3.	Material, articles or things are placed or stored on a structure that is a rack or stacking structure.	Clause 45 (b)	The rack or stacking structure is designed and tested for use in accordance with current applicable standards.
4.	A process involves a risk of ignition or explosion that creates a condition of imminent hazard to a person's health or safety.	Section 63	The process is conducted inside a spray booth that has been manufactured and installed in accordance with current applicable standards.
5.	The use of a dust collector involves a risk of ignition or explosion that creates a condition of imminent hazard to a person's health or safety.	Section 65	None.
6.	A factory produces aluminum or steel or is a foundry that melts material	Sections 87.3, 87.4, 87.5 and 88, subsections	None.

	or handles molten material.	90 (1), (2) and (3), and sections 91, 92, 94, 95, 96, 99, 101 and 102	
7.	Any of the following are used: 1. A travelling crane, overhead crane, monorail crane, gantry crane, jib crane or other lifting device suspended from or supported by a structure. 2. A vehicle lift or hoist.	Sections 51 and 53	1. The supporting structure was originally designed for the travelling crane, overhead crane, monorail crane, gantry crane, jib crane or other lifting device that is being installed or used. 2. The vehicle lift or hoist has been certified as meeting current applicable standards.
8.	A process uses or produces a hazardous biological or chemical agent and uses a ventilation system to limit the exposure of a worker in accordance with any exposure limit set out in Regulation 833 of the Revised Regulations of Ontario, 1990 (Control of Exposure to Biological or Chemical Agents) made under the Act.	Sections 127 and 128	A portable device that extracts smoke, fumes or other substances and that does not exhaust to the outdoors is used.

5.2 Premises (OHSA Reg. 851 S.11-20)

1. A floor or other surface used by any worker shall,
    a. be kept free of,
        i. obstructions,
        ii. hazards, and
        iii. accumulations of refuse, snow or ice; and
    b. not have any finish or protective material used on it that is likely to make the surface slippery. R.R.O. 1990, Reg. 851, s. 11.
2. Clearances between a moving part of any machine or any material carried by the moving part of the machine and any other machines, structure or thing shall be adequate to ensure that the safety of any worker in the area is not endangered .R.O. 1990, Reg. 851, s. 12.

3. (1) Subject to subsection (2), there shall be a guardrail,
    a. around the perimeter of an uncovered opening in a floor, roof or other surface to which a worker has access;
    b. at an open side of,
        i. a raised floor, mezzanine, balcony, gallery, landing, platform, walkway, stile, ramp or other surface, or
        ii. a vat, bin or tank, the top of which is less than 107 centimetres above the surrounding floor, ground, platform or other surface; and
    c. around a machine, electrical installation, place or thing that is likely to endanger the safety of any worker. R.R.O. 1990, Reg. 851, s. 13 (1).

    (2) Subsection (1) does not apply to,
    a. a loading dock;
    b. a roof to which access is required only for maintenance purposes;
    c. a pit used for,
        i. work on an assembly line, or
        ii. maintenance of vehicles or similar equipment; and
    d. a conveyor or similar system that transports a vehicle or vehicle part, and any raised platform used with the conveyor or similar system, if a guardrail would,
        i. obstruct the passage of the vehicle or vehicle part,
        ii. prevent a worker from performing work, or
        iii. pose a hazard to a worker. R.R.O. 1990, Reg. 851, s. 13 (2); O. Reg. 456/18, s. 1 (1).

    (3) If there is no guardrail in a situation described in subsection (2), an employer shall develop and implement other measures and procedures to protect workers from the hazard of falling. O. Reg. 456/18, s. 1 (2).
4. (1) A guardrail shall,
    a. have a top rail located not less than 91 and not more than 107 centimetres above the surface to be guarded;
    b. have a mid rail;
    c. if tools or other objects may fall on a worker, have a toe-board that extends from the surface to be guarded to a height of at least 125 millimetres; and
    d. be free of splinters and protruding nails. R.R.O. 1990, Reg. 851, s. 14 (1).

    (2) A guardrail shall be constructed to meet the structural requirements for guards as set out in the Building Code. R.R.O. 1990, Reg. 851, s. 14 (2).
5. A cover on an opening in a floor, roof or other surface shall be,
    a. secured in place; and
    b. constructed to meet the structural requirements for loads due to the use of floors and roofs as set out in the Building Code. R.R.O. 1990, Reg. 851, s. 15.
6. A door,
    a. Located or arranged so that it could be mistaken for an exit door; or
    b. Leading to a hazardous, restricted or unsafe area,

    Shall be identified by a warning sign posted on it. R.R.O. 1990, Reg. 851, s. 16.
7. A fixed walkway, service stair or stile shall be at least fifty-five centimetres in width. R.R.O. 1990, Reg. 851, s. 17.

8. (1) Subject to subsection (2), an access ladder fixed in position shall,
    a. be vertical;
    b. have rest platforms at not more than nine metre intervals;
    c. be offset at each rest platform;
    d. where the ladder extends over five metres, above grade, floor or landing, have a safety cage commencing not more than 2.2 metres above grade, floor or landing and continuing at least ninety centimetres above the top landing with openings to permit access by a worker to rest platforms or to the top landing;
    e. have side rails that extend ninety centimetres above the landing; and
    f. have rungs which are at least fifteen centimetres from the wall and spaced at regular intervals. R.R.O. 1990, Reg. 851, s. 18 (1); O. Reg. 420/10, s. 4.

    (2) Subsection (1) does not apply to an access ladder on a tower, water tank, chimney or similar structure which has a safety device which will provide protection should a worker using the ladder fall. R.R.O. 1990, Reg. 851, s. 18 (2).
9. Where frequent access is required to equipment elevated above or located below floor level, permanent platforms shall be provided with access by a fixed,
    a. stair; or
    b. access ladder. R.R.O. 1990, Reg. 851, s. 19.
10. Barriers, warning signs or other safeguards for the protection of all workers in an area shall be used where vehicle or pedestrian traffic may endanger the safety of any worker. R.R.O. 1990, Reg. 851, s. 20.

5.3 Machine Guarding (OHSA Reg. 851 S.24-44.2)

1. Where a machine or prime mover or transmission equipment has an exposed moving part that may endanger the safety of any worker, the machine or prime mover or transmission equipment shall be equipped with and guarded by a guard or other device that prevents access to the moving part. R.R.O. 1990, Reg. 851, s. 24.
2. An in-running nip hazard or any part of a machine, device or thing that may endanger the safety of any worker shall be equipped with and guarded by a guard or other device that prevents access to the punch point. R.R.O. 1990, Reg. 851, s. 25.
3. A machine shall be shielded or guarded so that the product, material being processed or waste stock will not endanger the safety of any worker. R.R.O. 1990, Reg. 851, s. 26.
4. An emergency stop control on a power-driven machine shall,
    a. be conspicuously identified; and
    b. be located within easy reach of the operator. R.R.O. 1990, Reg. 851, s. 27.
5. An operating control that acts as a guard for a machine not otherwise guarded shall,
    a. be in a location where the safety of the operator is not endangered by moving machinery;
    b. be arranged so that it cannot be operated accidentally; and
    c. not be made ineffective by a tie-down device or other means . R.R.O. 1990, Reg. 851, s. 28.
6. A grinding wheel shall be,
    a. Marked with the maximum speed at which it may be used;

b. Checked for defects before mounting;
c. Mounted in accordance with the manufacturer's specifications;
d. Operated at a speed which does not exceed the manufacturer's recommendations;
e. Provided with protective hoods that enclose the wheel as closely as the work will permit;
f. operated only by workers protected by eye protection; and
g. stored where it will not be subjected to,
    i. extreme heat or cold, or
    ii. damage from impact. R.R.O. 1990, Reg. 851, s. 29.

7. A work rest for a grinding wheel shall,
    a. Have a maximum clearance of 3mm from the grinding wheel;
    b. Be in a position above the centre line of the grinding wheel; and
    c. Not be adjusted while the grinding wheel is in motion. R.R.O. 1990, Reg. 851, s. 30.
8. A centrifugal extractor, separator or dryer shall have an interlocking device that will prevent,
    a. Any lid or covering guard from being opened or removal while the rotating drum or basket is in motion; and
    b. The starting of the drum or basket while the lid or covering guard is open or removed. R.R.O. 1990, Reg. 851, s. 31.
9. A tumbling will or tumbling dryer shall have a locking device which prevents any movement of the mill or dryer that may endanger any worker during loading or unloading. R.R.O. 1990, Reg. 851, s. 32.
10. Portions of conveyors or other moving machinery that are not visible from the control station, and where starting up may endanger any worker, shall be equipped with automatic start-up warning devices. R.R.O. 1990, Reg. 851, s. 33.
11. Guards shall be provided beneath conveyors that pass over any worker; or from which falling material, including broken conveyor parts, may be a hazard to any worker. R.R.O. 1990, Reg. 851, s. 34.
12. Overhead protection shall be provided where falling material may endanger any worker. R.R.O. 1990, Reg. 851, s. 35.
13. (1) Subject to subsection (2), an explosive actuated fastening tool shall,
    a. Have a firing mechanism that will prevent the tool from being fired
        i. While being loaded,
        ii. During preparation for firing, or
        iii. If dropped;
    b. Be capable of being operated only when the muzzle end is held against a working surface with a force of at least 22 N greater than the weight of the tool;
    c. If required to be dismantled into separate parts for loading, be capable of being operated only when the separate parts are firmly locked together;
    d. Be capable of being fired only after two separate and distinct actions have been carried out by the operator, with the firing movement separate from the operation of bringing the tool into the firing position;
    e. Be used only when equipped with a protective guard or shield,

i. Suitable for the particular fastening operation being performed,
ii. Mounted at right angles to the barrel,
iii. At least 75mm in diameter, and
iv. Placed in a central position on the muzzle end of the tool except where the fastener is intended to be driven into a surface at a point within 38mm of another surface that is at any angle to the surface into which the fastener is intended to be driven;

f. be capable of being operated when the guard prescribed by clause (e) is placed in the central position only when the bearing surface of the guard is tilted not more than eight degrees from the working surface;
g. when not in use, be stored in a locked container;
h. not be left unattended where it may be available to a person other than a worker having the qualifications set out in subclause (k) (i);
i. Whether loaded or unloaded, not to be pointed directly at any person;
j. not be loaded unless it is being prepared for immediate use;
k. Be used only,
   i. by a worker who has been instructed in the proper and safe manner of its use by the manufacturer or the manufacturer's authorized and qualified agent,
   ii. by a worker wearing both head protection and eye protection,
   iii. after it has been inspected by the worker referred to in subclause (i) to ensure that,
      1. The tool is clean,
      2. All moving parts operate freely,
      3. The barrel is free from any obstruction,
      4. The tool is adequately equipped for the intended use, and
      5. It is not defective
   iv. in accordance with the instructions of the manufacturer,
   v. With an explosive load of a strength adequate to perform the intended work without excessive force, and
   vi. To drive a stud or other fastener suitable for insertion in the tool; and
l. Not to be used in an atmosphere containing flammable vapours, gasses or dust. R.R.O. 1990, Reg. 851, s. 36 (1).

(2) Clauses (1) (e) and (f) do not apply to an explosive actuated fastening tool if the velocity of the stud or other fastener does not exceed ninety metres per second measured at a distance of two metres from the muzzle end of the tool when propelled by the maximum commercially available explosive load that the tool is chambered to accept. R.R.O. 1990, Reg. 851, s. 36 (2).

(3) A misfired cartridge that has been removed from an explosive actuated fastening tool shall be placed in a water filled container until the cartridge may be properly disposed of after its safe removal from the industrial establishment. R.R.O. 1990, Reg. 851, s. 36 (3).

14. An explosive load for an explosive actuated fastening tool shall,
   a. Be so marked or labelled that the operator can readily identify its strength;

b. Not be stored in a container where an explosive load of a different strength is stored;
c. not be left unattended where it may be available to a person other than a worker having the qualifications set out in subclause 36 (1) (k) (i); and
d. when not in use, be stored in a locked container. R.R.O. 1990, Reg. 851, s. 37.

15. A hand-held nailing gun or similar tool shall be,
    a. capable of being operated only when in contact with the work surface; and
    b. operated only,
        i. by a competent person, and
        ii. when the operator is wearing eye protection. R.R.O. 1990, Reg. 851, s. 38.
16. A chain saw shall,
    a. Have,
        i. A chain that minimizes the possibility of a kickback, and
        ii. A device which will effectively stop the chain in the event of a kickback;
    b. Be in safe operating condition;
    c. when being started, be held firmly;
    d. when being used, be held firmly by both hands; and
    e. Have the chain stopped when not actually cutting. R.R.O. 1990, Reg. 851, s. 39.
17. Electrical equipment, insulating materials and conductors shall be,
    a. Suitable for their use; and
    b. Certified by
        i. The Canadian Standards Association, or
        ii. The Electrical Safety Authority, as defined in the Electricity Act, 1998. R.R.O. 1990, Reg. 851, s. 40; O. Reg. 144/99, s. 2; O. Reg. 420/10, s. 6.
18. The entrance to a room or similar enclosure containing exposed live electrical parts shall have a conspicuous sign, warning of the danger, and forbidding entry by unauthorized persons. R.R.O. 1990, Reg. 851, s. 41.
19. (1) The power supply to electrical installations, equipment or conductors shall be disconnected, locked out of service and tagged before any work is done, and while it is being done, on or near live exposed parts of the installations, equipment or conductors. O. Reg. 630/94, s. 1
    (2) Before beginning the work, each worker shall determine if the requirements of subsection (1) have been complied with. O. Reg. 630/94, s. 1.
    (3) Locking out is not required,
    a. if the conductors are adequately grounded with a visible grounding mechanism; or
    b. if the voltage is less than 300 volts and there is no locking device for the circuit breakers or fuses and procedures are in place adequate to ensure that the circuit is not inadvertently energized. O. Reg. 630/94, s. 1.

(4) If locking out is not required for the reason set out in clause (3) (b), the employer shall ensure that the procedures required by that clause are carried out. O. Reg. 630/94, s. 1.

(5) If more than one worker is involved in the work referred to in subsection (1), the worker who disconnected and locked out the power supply shall communicate the purpose and status of the disconnecting and locking out. O. Reg. 630/94, s. 1.

(6) If a tag is used as a means of communication, the tag,

a. shall be made of non-conducting material;
b. shall be secured to prevent its inadvertent removal;
c. shall be placed in a conspicuous location;
d. shall state the reason the switch is disconnected and locked out;
e. shall show the name of the worker who disconnected and locked out the switch; and
f. shall show the date on which the switch was disconnected and locked out. O. Reg. 630/94, s. 1.

(7) The employer shall establish and implement written procedures for compliance with this section. O. Reg. 630/94, s. 1.

20. (1) This section applies and section 42 does not apply if it is not practical to disconnect electrical installations, equipment or conductors from the power supply before working on, or near, live exposed parts of the installations, equipment or conductors. O. Reg. 630/94, s. 1.

(2) The worker shall use rubber gloves, mats, shields and other protective equipment and procedures adequate to ensure protection from electrical shock and burns while performing the work. O. Reg. 630/94, s. 1.

(3) If the installation, equipment or conductor is operating at a nominal voltage of 300 volts or more, a suitably equipped competent person who is able to recognize the hazards and perform rescue operations, including artificial respiration, shall be available and able to see the worker who is performing the work. O. Reg. 630/94, s. 1.

(4) Subsection (3) does not apply to equipment testing and trouble-shooting operations. O. Reg. 630/94, s. 1.

21. Work performed on electrical transmission systems or outdoor distribution systems rated at more than 750 volts shall be performed in accordance with the document entitled “Electrical Utility Safety Rules”, published by the Infrastructure Health and Safety Association and revised in 2019. O. Reg. 60/18, s. 3; O. Reg. 186/19, s. 3.
22. Tools and other equipment that are capable of conducting electricity and endangering the safety of any worker shall not be used in such proximity to any live electrical installation or equipment that they might make electrical contact with the live conductor. R.R.O. 1990, Reg. 851, s. 43.
23. (1) Cord-connected electrical equipment and tools shall have a casing that is adequately grounded. O. Reg. 630/94, s. 2.

(2) Subsection (1) does not apply to cord-connected electrical equipment or tools that are adequately double-insulated and whose insulated casing shows no evidence of cracks or defects. O. Reg. 630/94, s. 2.

(3) Subsection (1) does not apply to a portable electrical generator in which the electrical equipment or tools are not exposed to an external electric power source if

the casing of portable electrical equipment or tools connected to the generator is bonded to a non-current-carrying part of the generator. O. Reg. 420/10, s. 7.

24. When used outdoors or in wet locations, portable electrical tools shall be protected by a ground fault circuit interrupter installed at the receptacle or on the circuit at the panel. O. Reg. 630/94, s. 2.
25. A ground fault that may pose a hazard shall be investigated and removed without delay. O. Reg. 630/94, s. 2.

5.4 Lockout/Tag out

1. Standards that apply: Canadian standard CSA Z460:20 "Control of Hazardous Energy - Lockout and Other Methods".
2. All equipment/machines with the use of any energy source shall have the ability to be locked out.
3. Lock out controls/disconnects shall be located in an easily accessible location on or within the equipment/machine.
4. Information on all lockout of energy sources shall be provided.

5.5 Ergonomics

1. The equipment/machine should allow an operator to work in a neutral posture.
    a. Work shall not require an operator to work with:
        i. Neck flexion >20 degrees
        ii. Neck extension
        iii. Neck lateral bend
        iv. Shoulder flexion >45 degrees
        v. Shoulder extension>20 degrees
        vi. Ulnar and radial deviation of the wrist
        vii. Back extension
        viii. Back flexion >60 degrees
        ix. Back lateral bend
        x. Back rotation
    b. Height is adjustable (including elevated fixtures on the work surface)

Work contents	**Working heights in mm**			
	Group 1	Group 2	Group 3	Group 4
High requirements for Visual inspection Fine motor skills	1100	1200	1250	1350
Medium requirements for Visual inspection Fine motor skills	1000	1100	1150	1250
Low requirements for Visual inspection **High requirements for** Elbow-room	900	1000	1050	1150
	Average optimum working height = 1125			

Group 1: Smallest woman (only 5% are smaller), Group 2: Average woman and smallest man, Group 3: Largest woman and average man, & Group 4: Largest man (only 5% are larger).

   c. Shelving be located and tilted according to the frequency of use and item (items used/retained at a high frequency shall be located closer to the user)
2. The equipment/machine shall not require a lift, lower, carry, push, or pull greater than 11lbs for the operator to operate.
3. Shall allow cycles to run at the maximum 2 times per minute.
4. If further calculation is required for the Maximum Acceptable Effort (MAE), the following formula should be used to estimate the risk associated with the duty cycle (AKA cycle time).
   a. MAE = 1- (DC – [1/28,800]$^{0.24}$
      i. Maximum Acceptable Effort (MAE) is the average maximum voluntary effort (MVE, in force of torque), where 1.0 represents 100% of the MVE,
      ii. Duty Cycle (DC), the portion of a task cycle in which effort is exerted, where 1.0 represents 100% of the cycle,
      iii. 28, 800 is the number of seconds in 8 hours
5. Tools with vibration shall be minimized with anti-vibration properties.
6. Size of workstation is sufficient for the task performed.
7. Tools
   a. Pliers and Snips Guidelines
      i. Handle grip span: ≥2” [51 mm] when fully closed, ≤ 3.5” [89 mm] when fully open.
      ii. Handle (grip) diameter: 0.3 – 0.6” [8 – 15 mm]; provide larger diameter thumb stop at top of handle.
      iii. Handle (grip) shape: oval or flattened.
      iv. Handle (grip) length: 5.5” [140 mm].
      v. Handle angle: bent handles, with angle between jaw head and handle 105-135^{o}.
      vi. Handle (grip) surface, texture, material: high-friction or non-slip, slightly soft composite, or rubber.
   b. Wrench Guidelines
      i. Handle (grip) diameter: 1.2 – 2” [30 - 51 mm].
      ii. Handle (grip) shape: circular.
      iii. Handle (grip) length: 4 – 6” [102 – 152 mm].
      iv. Handle (grip) surface, texture, material: high-friction, non-slip, or slightly etched, slightly soft composite or rubber.
   c. Right-angle Powered Fastening Tool Guidelines
      i. Handle (grip) cross-sectional shape: cylindrical
      ii. Handle (grip) shape: cylindrical [symmetrical diameter]
      iii. Handle (grip) diameter: 2” [51 mm]; provide larger diameter flange at bottom of handle
      iv. Handle (grip) length: 4-6” [102 – 152 mm]
      v. Handle angle: perpendicular to aiming/fastening axis

vi. Handle (grip) surface, texture, material: high-friction or slightly etched, slightly soft composite or rubber
vii. Dynamic reaction force (torque): ≤ 37 lb-ft [50 Nm]
viii. Hydraulic pulse systems or automatic shut-off to reduce torque reaction peak, duration. Faster shut-off mechanisms reduce peak reaction torques.
ix. Weight: ≤ 4 lb [1.8 kg] or suspended.
x. Finger(s) trigger design: lever with recommended length ≤3" [76 mm]
xi. Finger(s) trigger force: level force ≤ 6.8 lb [3.1 kg]

d. In-line Powered Fastening Tool Guidelines
i. Handle (grip) cross-sectional shape: cylindrical
ii. Handle (grip) shape: cylindrical
iii. Handle (grip) diameter: 2" [51 mm]; provide larger diameter flange at bottom of handle
iv. Handle angle: in line with tool-aiming axis
v. Handle (grip) surface, texture, material: high-friction or slightly etched, slightly soft composite or rubber
vi. Dynamic reaction force (torque): ≤2.36 lb-ft [3.2 Nm]
vii. Hydraulic pulse systems or automatic shut-off to reduce torque reaction peak, duration. Faster shut-off mechanisms reduce peak reaction torques.
viii. Weight: ≤ 4 lb [1.8 kg] or suspended.
ix. Finger(s) trigger design: push to start

e. Pistol-grip Powered Fastening Tool Guidelines
i. Handle (grip) cross-sectional shape: cylindrical
ii. Handle (grip) shape: cylindrical (symmetrical diameter)
iii. Handle (grip) diameter: 2" [51 mm]; provide larger diameter flange at bottom of handle
iv. Handle (grip) length: 4 – 6" [102 – 152 mm]
v. Handle angle: 102° angle from handle to aiming axis
vi. Handle (grip) surface, texture, material: high-friction or slightly etched, slightly soft composite or rubber
vii. Dynamic reaction force (torque): ≤5.02 lb-ft [6.8 Nm]
viii. Hydraulic pulse systems or automatic shut-off to reduce torque reaction peak, duration. Faster shut-off mechanisms reduce peak reaction torques.
ix. Weight: ≤ 4 lb [1.8 kg] or suspended.
x. Finger(s) trigger design: 2-finger (index, middle) trigger, recommendation length 1.5 – 2.5" [38 – 64 mm]
xi. Finger(s) trigger force: 2-finger, ≤5 lb [2.3 kg]; 1-finger, ≤ 2.5 lb [1.1 kg]

8. Vibration
    a. Segmental Vibration Guidelines

Threshold Limit Values for Hand Vibration Exposure – U.S.	
Total daily exposure duration (hours)	**Max. value of frequency-weighted acceleration (m/s^2) in any direction**
4 to less than 8	4
2 to less than 4	6
1 to less than 2	8
Less than 1	12

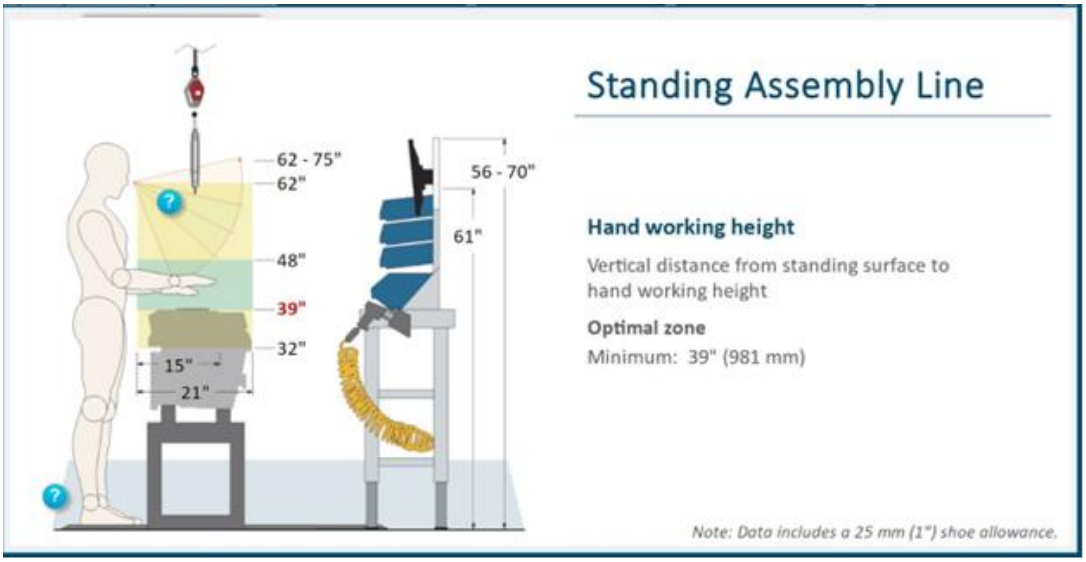
Daily Exposure Values for Hand-Arm Vibration – Europe	
Action value (EAV)	2.5 m/s^2
Limit value (ELV)	5 m/s^2

    b. Whole-body Vibration Guidelines

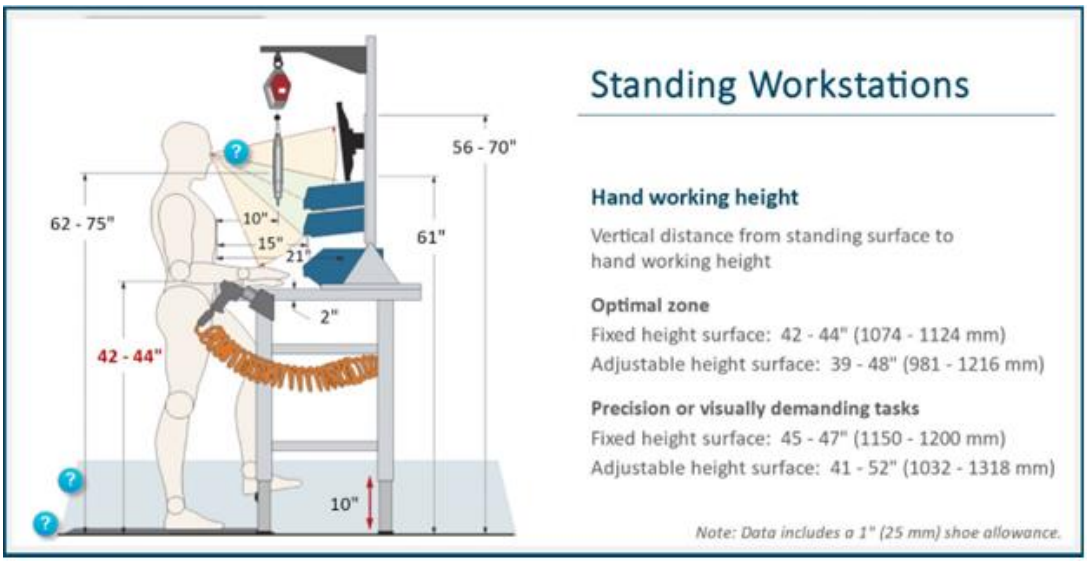
Threshold Limit Values for Hand Vibration Exposure – U.S.		
Total Daily Exposure	**Value of dominant RMS acceleration component, m/s^2**	
	Longitudinal (foot to head)	**Transverse (side to side or back to chest)**
24 hours	0.140	0.100
16 hours	0.192	0.135
8 hours	0.315	0.224
4 hours	0.530	0.355
2.5 hours	0.710	0.500
1 hour	1.18	0.850
25 minutes	1.80	1.25
16 minutes	2.12	1.50
1 minute	2.80	2.00

Daily Exposure Values for Hand-Arm Vibration – Europe	
Action value (EAV)	0.5 m/s^2
Limit value (ELV)	1.15 m/s^2

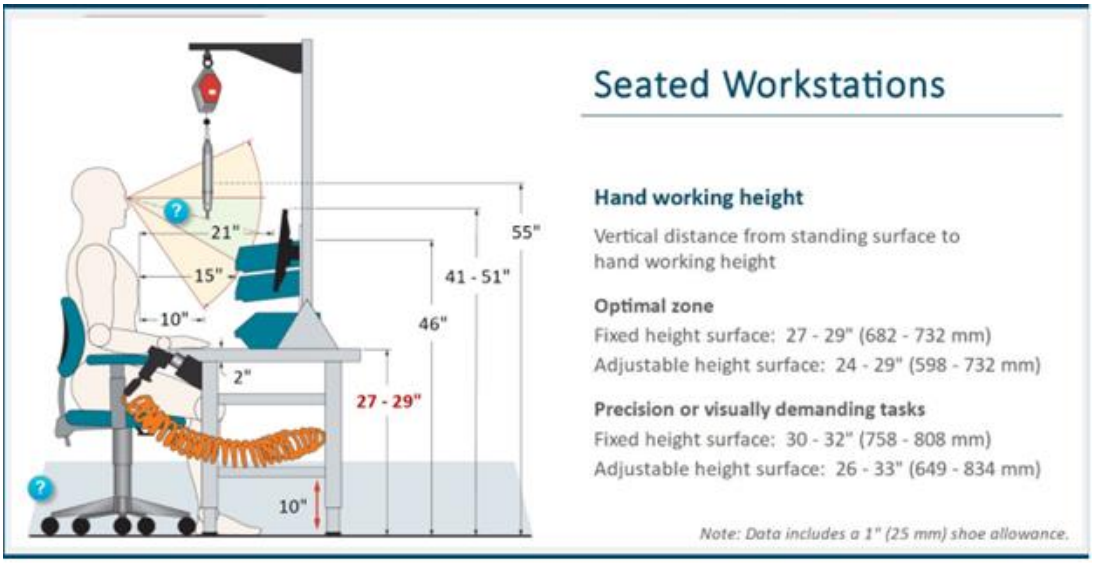
9. Standing Assembly Line Guidelines



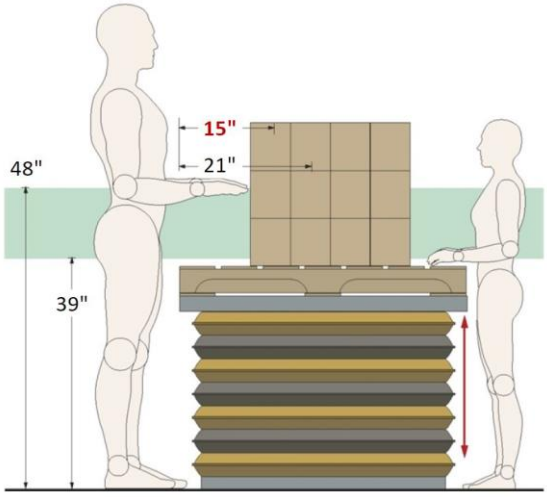
10. Standing Workstations



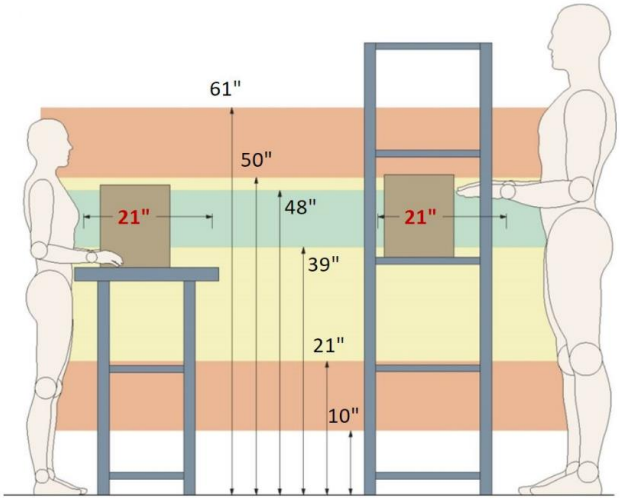
11. Seated Workstations



12. Adjustable Height Surface Guidelines
    a. Horizontal reach: Horizontal reach distance from front edge of workstation to hand grasping point; Optimal: 15” [359 mm]



13. Fixed Height Surface Guidelines
    a. Horizontal reach: From front edge of workstation to hand grasping point; Maximum: 21” [531 mm]



14. Arm Strength

a. Upper Force Limits for Horizontal Pushing and Pulling

Condition	**Forces that should not be exceeded**	**Examples of Activities**
Standing (whole body involved)	225N (50 lb or 23kgf]	Truck and cart handling. Moving equipment on wheels or casters. Sliding rolls on shafts.
Standing (primary arm and shoulder muscles, arms fully extended)	110 N (24 lbf or 11 kgf)	Leaning over an obstacle to move an object. Pushing an object at or above shoulder height.
Kneeling	188 N (42 lbf or 21 kgf)	Removing or replacing a component from equipment as in maintenance work.
Seated	130 N (29 lbf or 13 kgf)	Operating a vertical lever, such as a floor shift on heavy equipment.

b. Upper Force Limits for Vertical Pushing and Pulling

Condition	**Forces that should not be exceeded**	**Examples of Activities**
Pull down - Above head height	540 N (120 lbf or 55 kgf)	Activating a control, hook grip; such as a safety shower handle or manual control.
Pull down - Shoulder level	200 N (45 lbf or 20 kgf)	Operating a chain hoist, power grips; less than 5 cm (2 in) diameter grip surface.
Pull up - 25 cm above the floor	315 N (70 lbf or 32 kgf)	Stringing cable, threading up a paper machine, activating a control.
Pull up - Elbow height	148 N (33 lbf or 15 kgf)	Raising a lid or access port.
Pull up - Shoulder height	75 N (17 lbf or 7.5 kgf)	Raising a lid, palm up.
Boost up - Shoulder height	200 N (45 lbf or 20 kgf)	Raising a corner or end of an object, like a pipe; boosting an object to a high shelf.
Push down - Elbow height	290 N (64 lbf or 29 kgf)	Wrapping, packing, and sealing cases.

c. Push out at shoulder height, 1 hand

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
6.8 lb [3.1 kg]	10.2 lb [4.6 kg]	17.0 lb [7.7 kg]	22.1 lb [10.1 kg]

d. Push out at elbow height, 1 hand

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
7.4 lb [3.4 kg]	11.1 lb [5.1 kg]	18.5 lb [8.4 kg]	24.1 lb [11.0 kg]

e. Push out at elbow height, 2 hands

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
11.8 lb [5.4 kg]	17.7 lb [8.0 kg]	29.5 lb [13.4 kg]	38.3 lb [17.4 kg]

f. Pull in at shoulder height, 1 hand

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
7.0 lb [3.2 kg]	10.5 lb [4.8 kg]	17.6 lb [8.0 kg]	22.8 lb [10.3 kg]

g. Pull in at elbow height, 1 hand

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
7.5 lb [3.4 kg]	11.2 lb [5.4 kg]	18.7 lb [8.5 kg]	24.3 lb [11.1 kg]

h. Pull in at elbow height, 2 hands

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
13.1 lb [5.9 kg]	19.6 lb [8.9 kg]	32.7 lb [14.8 kg]	42.4 lb [19.2 kg]

i. Pull up from overhead, 2 hands

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
17.9 lb [8.1 kg]	26.8 lb [12.2 kg]	44.7 lb [20.3 kg]	58.1 lb [26.4 kg]

j. Pull up from knee height, 1 hand

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
6.3 lb [2.9 kg]	9.5 lb [4.3 kg]	15.8 lb [7.2 kg]	20.5 lb [9.3 kg]

k. Pull across body (lateral) at waist height, 1 hand, elbow fully extended

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
2.5 lb [1.1 kg]	3.8 lb [1.7 kg]	6.3 lb [2.9 kg]	8.2 lb [3.7 kg]

l. Pull across body (lateral) at waist height, 1 hand, elbow at 90°

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
3.3 lb [1.5 kg]	5.0 lb [2.3 kg]	8.4 lb [3.8 kg]	10.8 lb [4.9 kg]

m. Lift up at shoulder height, 2 hands

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
4.7 lb [2.1 kg]	7.0 lb [3.2 kg]	11.7 lb [5.3 kg]	15.3 lb [6.9 kg]

n. Lift up at elbow height, 2 hands

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
7.7 lb [3.5 kg]	11.5 lb [5.2 kg]	19.1 lb [8.7 kg]	24.9 lb [11.3 kg]

o. Press down at elbow height, 2 hands

Frequent (≥2/min.)		Infrequent (≤2/min.)	
Recommended	Acceptable	Recommended	Acceptable
12.8 lb [5.8 kg]	19.2 lb [8.7 kg]	30.0 lb [13.6 kg]	41.6 lb [18.9 kg]

15. Hand Strength

a. Finger Push Force

Force Exertions: **Finger Push**	Frequent (≥2/min.)		Infrequent (≤2/min.)	
	Recommended	Acceptable	Recommended	Acceptable
1 index finger	3.4 lb [1.5 kg]	5.0 lb [2.3 kg]	8.6 lb [3.9 kg]	11.2 lb [5.1 kg]
2 fingers, same hand	5.0 lb [2.3 kg]	7.5 lb [3.4 kg]	12.5 lb [5.7 kg]	16.3 lb [7.4 kg]
2 fingers, different hands	11.0 lb [5.0 kg]	16.5 lb [7.5 kg]	27.5 lb [12.5 kg]	35.8 lb [16.3 kg]

b. Finger Pull Force

Force Exertions: **Finger Pull**	Frequent (≥2/min.)		Infrequent (≤2/min.)	
	Recommended	Acceptable	Recommended	Acceptable
1 finger	3.9 lb [1.8 kg]	6.0 lb [2.7 kg]	9.6 lb [4.3 kg]	12.5 lb [5.7 kg]
2 fingers, same hand	8.4 lb [3.8 kg]	12.5 lb [5.7 kg]	20.9 lb [9.5 kg]	27.1 lb [12.3 kg]

c. Thumb Push Force

Force Exertions: **Thumb Push**	Frequent (≥2/min.)		Infrequent (≤2/min.)	
	Recommended	Acceptable	Recommended	Acceptable
1 thumb	5.3 lb [2.4 kg]	8.0 lb [3.6 kg]	13.3 lb [6.0 kg]	17.3 lb [7.8 kg]
2 thumbs	10.0 lb [4.5 kg]	15.0 lb [6.8 kg]	25.0 lb [11.3 kg]	32.5 lb [14.7 kg]

d. One-Handed Pinch Grip Force

Force Exertions: **Pinch Grip**	Frequent (≥2/min.)		Infrequent (≤2/min.)	
	Recommended	Acceptable	Recommended	Acceptable
Chuck pinch grip* (with wrist deviation)	2.0 lb [0.9 kg]	2.4 lb [1.1 kg]	4.0 lb [1.8 kg]	5.1 lb [2.3 kg]
Chuck pinch grip (with no wrist deviation)	3.2 lb [1.4 kg]	4.7 lb [2.1 kg]	7.9 lb [3.6 kg]	10.3 lb [4.7 kg]
Key pinch grip* (with wrist deviation)	2.0 lb [0.9 kg]	2.9 lb [1.3 kg]	4.8 lb [2.2 kg]	6.3 lb [2.9 kg]
Key pinch grip (with no wrist deviation)	3.9 lb [1.8 kg]	6.0 lb [2.7 kg]	9.7 lb [4.4 kg]	12.6 lb [5.7 kg]

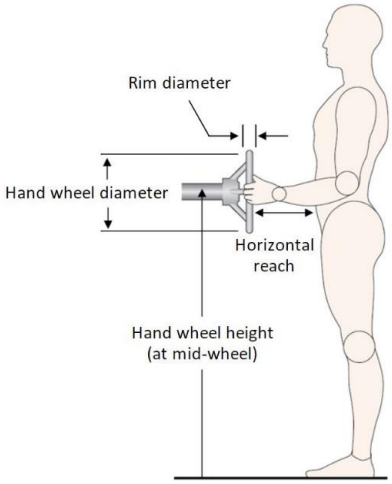
e. Power Grip Force

Force Exertions: **Power Grip**	Frequent (≥2/min.)		Infrequent (≤2/min.)	
	Recommended	Acceptable	Recommended	Acceptable
1 hand (with wrist deviation*)	6.4 lb [2.9 kg]	9.5 lb [4.3 kg]	15.9 lb [7.2 kg]	20.7 lb [9.4 kg]
1 hand (with no wrist deviation)	12.7 lb [5.8 kg]	19.1 lb [8.7 kg]	31.8 lb [14.4 kg]	41.3 lb [18.7 kg]
2 hands (with wrist deviation*)	9.0 lb [4.1 kg]	13.5 lb [6.1 kg]	22.6 lb [10.2 kg]	29.3 lb [13.2 kg]
2 hands (with no wrist deviation)	18.0 lb [8.2 kg]	27.1 lb [12.3 kg]	45.1 lb [20.5 kg]	58.6 lb [26.7 kg]
*Noticeable flexion, extension, ulnar, and radial deviation. This applies to most check fixture clamps at Tiercon and Coplas.				

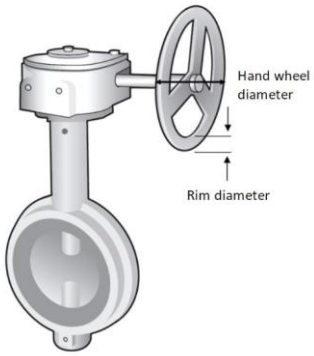
f. Insertion/Removal Force

Force Exertions: **Insertion/Removal**	Frequent (≥2/min.)		Infrequent (≤2/min.)	
	Recommended	Acceptable	Recommended	Acceptable
With 1-handled grip on plastic surface	6.7 lb [3.1 kg]	10.1 lb [4.6 kg]	16.9 lb [7.7 kg]	21.9 lb [9.9 kg]
With 1-handed grip on rubber surface	8.0 lb [3.6 kg]	12.0 lb [5.4 kg]	20.0 lb [9.1 kg]	25.9 lb [11.8 kg]

16. Hand Wheels
    a. Large Hand Wheels (> 10” Diameter)
        i. Type: Vertical mechanized hand wheels preferred
        ii. Manual breaking forces: ≤ 70 lb [31.8 kg]; not-to-exceed: 110 lb [49.9 kg]
        iii. Manual turning forces: ≤ 35 lb [15.9 kg]; not-to-exceed: 75 lb [34 kg]
        iv. Rim diameter: 2” [51 mm]
        v. Hand wheel diameter: ≥30” [762 mm]
        vi. Hand wheel height:
            1. Vertical hand wheel (mid-wheel): 49 – 62” [1.25 – 1.58 m]
            2. Horizontal hand wheel: 38 – 47” [0.97 – 1.19 m]
        vii. Horizontal reach distance: ≤11” [279 mm]
        viii. Accessibility: Min. access around wheel: 46” [1.17 m]; min. hand access: 6” [152 mm]



17. Small Hand Wheels (≤ 10” Diameter)
    a. Maximum breaking forces:
        i. 1-handed operation: ≤ 29 lb [13.2 kg]
        ii. 2-handed operation: ≤ 49 lb [22.2 kg]
    b. Rim diameter: 2” [51 mm]
    c. Hand wheel diameter: 5” – 10” [127 – 254 mm]



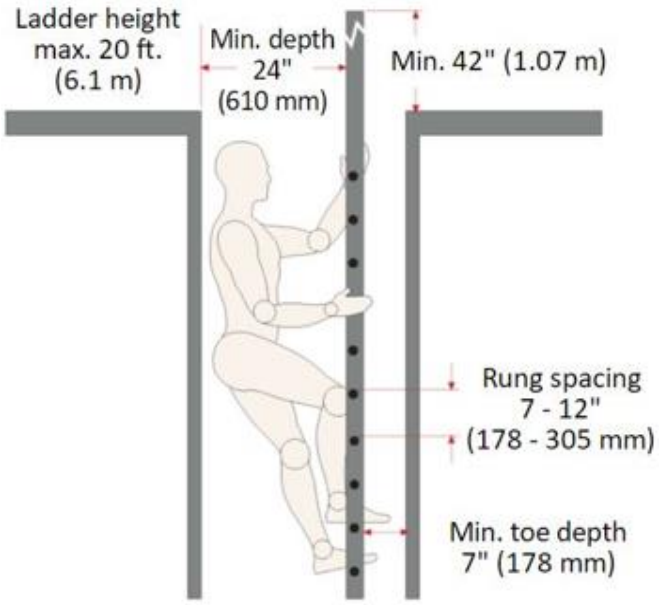
18. Material Handling Guideline – Drum
    a. Use powered equipment for drums weighing > 500 lb [227 kg]
    b. Use dolly/hand cart for drums weighing <500 lb [227 kg]
    c. Use low-profile equipment (scales, pallets) to minimize handling
19. Material Handling Guideline – Hand cart/hand truck
    a. Vertical handles (preferred for smaller carts that turn easily):
        i. Length minimum 5” [127 mm]
        ii. Height 36 – 49” [0.9 – 1.23 m]
        iii. Position 16 – 20” apart [406 – 508 mm]
    b. Horizontal handles (preferred for turning larger carts):
        i. Length ≥24” [609 mm]
        ii. Height 38 – 45” [0.95 – 1.14 m]
    c. Handle diameter: 2” [51 mm]

d. Handle offset for foot placement: ≥ 8” [203 mm] preferred

20. Material Handling Guideline – Lift assist
    a. Handle criteria:
        i. Position 16 – 20” apart [406 – 508 mm]
        ii. Height 39-48” [981 -1216 mm] from floor
    b. Maneuvering forces (two hands at elbow height):
        i. Frequent > 2/minute: 11.8 lb [5.4 kg]
        ii. Infrequent < 2/minute: 29.5 lb [13.4 kg]
    c. Visual access to end effector
21. Material Handling Guideline – Lift table/load leveler
    a. Minimum 36” [914 mm] height adjustability
    b. Powered adjustment preferred
    c. Hand controls preferred
    d. Rotating top
    e. Low-profile table if forklift use is limited
22. Material Handling Guideline – wheel/caster
    a. General recommendation: minimum wheel diameter 8” [203 mm]. A smaller caster size us acceptable if it meets push/pull force guidelines.
    b. 4-wheel non-tilt (all swivel)
        i. Multi-directional
        ii. Ideal for confined areas
        iii. Difficult straight-line travel
        iv. Not towable
23. Pedestrian Aisle Access guideline
    a. Minimum width to accommodate one person transporting equipment or products: 48” [1.22 m].
        i. Primary aisle 72” wide [1.83 m].
        ii. Secondary aisles 48” [1.22 m].
    b. Minimum height for one person: 80” [2.03 m].
    c. Use floor markers to identify walkways/pathways.
    d. Where possible, avoid locating aisle against walls (where access is limited to one side).
24. Door Access Guidelines
    a. High and wide enough to accommodate materials and transfer systems (carts, dollies, forklifts, etc.).
    b. Power-assist doors for high-traffic areas.
    c. Low-force doors where manual material handling (carrying) occurs.
    d. Adhere to Accessibility for Ontarians with Disabilities Act (AODA) and/or Americans with Disabilities Act (ADA) where appropriate.
    e. Avoid having doors open into aisles.
25. Maintenance Access Guidelines
    a. Horizontal clearance: minimum 46” [1.17 m] beside or around a piece of equipment
    b. Vertical clearance: minimum 80” [2.03 m] above any piece of equipment requiring overhead maintenance

c. Hand clearance: minimum 2” [51 mm] between equipment to be removed and surrounding equipment
d. Hand access diameter: minimum 8” [203 mm] to enable one-handed force exertion
e. Horizontal clearance; minimum 46” [1.17 m] beside or around a piece of equipment
f. Vertical clearance: minimum 80” [2.03 m] above any piece
g. Other considerations:
    i. Provide clearance to components for regular maintenance; maintenance and diagnostic equipment; fixed/mobile mechanical lifting devices; person-lifts/mobile platforms for overhead work
    ii. Provide clear, unobstructed path to equipment
    iii. Access ports should provide visual access to displays when making adjustments

26. Platform Access Guidelines
    a. Minimum deck size: 24 x 25” [610 x 635 mm]
    b. Adjustment mechanism:
        i. Power platform
        ii. For maintenance and diagnostic equipment
    c. Install toe plates and handrails for platforms higher than 48” [122 mm]
    d. Deck material should be suitable for work environment (stainless steel, aluminium, chemical resistant, etc.)
27. Fixed Ladder Access Guidelines
    a. 75^{o} – 90^{o} from floor.
    b. Maximum height: 20 ft. [6.1 m] without landing platform.
    c. Minimum height extended above surface: 42” [1.07 m].
    d. Minimum passage width: 30” [762 mm].
    e. Rung space: uniform distance, 7-12” [178 – 305 mm].
    f. Minimum rung length: 16” [406 mm].
    g. Rung diameter: uniform diameter, 0.75 – 1.5” [19 – 38 mm].
    h. Minimum toe depth clearance: 7” [178 mm].
    i. Use fixed ladders to move up slopes more than 75° from floor.
    j. Ascend/descend fixed ladders while facing them.
    k. See OSHA standard 29 CFR 1910.27.



28. Arm Access (elbow to hand), 1 arm
    a. Opening: Circular
    b. Minimum (width x height)/diameter: 7.5” [191mm] diameter
29. Arm Access (shoulder to hand), 1 arm
    a. Opening: Circular
    b. Minimum (width x height)/diameter: 8” [203mm] diameter
30. Hand Access (empty), 1 hand
    a. Opening: Rectangular
    b. Minimum (width x height)/diameter: 4” x 2.5” [102 x 64 mm)
31. Hand Access (empty), 2 hands
    a. Opening: Rectangular
    b. Minimum (width x height)/diameter: 6” x 5” [152 x 127 mm]
32. Hand Access (large object), 1 hand
    a. Opening: Rectangular
    b. Minimum (width x height)/diameter: 8” x 8” [203 x 203 mm]
33. Hand Access (small object), 1 hand
    a. Opening: Rectangular
    b. Minimum (width x height)/diameter: 6” x 6” [152 x 152 mm]
34. Knob access, 2 fingers
    a. Opening: Circular
    b. Minimum (width x height)/diameter: 3.5” [89 mm] diameter
35. Push button Access, a finger
    a. Opening: Circular
    b. Minimum (width x height)/diameter: 1.5” [38 mm] diameter
36. Allen wrench Access
    a. Using Allen-type wrench, with freedom to turn wrench through 60°
    b. Minimum: 4.7 W x 6.3” H [119 x 160 mm]

37. Open-end wrench Access
    a. Using Allen-type wrench, with freedom to turn wrench through 60°
    b. Minimum: 10 W x 6.3” H [254 x 160 mm]
38. T-handle wrench Access
    a. Using T-handle wrench, with freedom to turn hand through 180°
    b. Minimum: 5.5 W x 6.3” H [140 x 160 mm]
39. Screwdriver Access
    a. Using common screwdriver, with freedom to turn hand through 180°
    b. Minimum: 4.3 W x 4.7” H [109 x 119 mm]
40. Pliers Access
    a. Using pliers and similar tools
    b. Minimum: 5.1 W x 4.7” H [130 x 119 mm]
41. Test probe Access
    a. Using test probe
    b. Minimum: 3.1 W x 3.5” H [79 x 89 mm]
42. For all arm, hand, knob and tools in hand access, other considerations are:
    a. Add 0.75” [19mm] if wearing gloves
    b. Design to minimize sharp edges
    c. Design access openings to accommodate part size and hand clearance
43. See OSHA standards 29 CFR 1910.66, 29 CFR 1910.67, and 29 CFR 1910.68
44. Workstation must allow for a spacious means of egress.

5.6 Programmable Logic Controller

1. The programmable logic controller (PLC) will be sold and owned by Tiercon Corp. & Coplas Inc. including any information pertinent to the PLC such as pin codes, passwords, work instructions, etc.).

5.7 Noise (O. Reg. 381/15: NOISE)

1. The equipment shall not have a sound level greater than an equivalent sound exposure level of 85dBA (TWA) O. Reg. 381/15., s. 4.

5.8 Industrial Hygiene (OHSA Reg. 851 S.124-139)

1. (1) Where a worker is required to work with, or is likely to be exposed to, a hazardous biological or chemical agent that could cause injury to the eye or skin, an employer shall provide as many of the following as are needed for adequate emergency treatment:
    a. Eye wash facilities.
    b. Emergency showers.
    c. Antidotes, flushing fluids or washes. O. Reg. 186/19, s. 7.

    (2) The emergency equipment or treatments described in subsection (1) must,
    a. be clearly marked with a sign or label;
    b. be located or installed in a conspicuous place near where the hazardous biological or chemical agent is kept or used;

c. be readily accessible to workers; and
d. have instructions for its use displayed on the equipment or treatment or as near to it as is practical. O. Reg. 186/19, s. 7.

2. Removal of material shall be done in such a way as not to cause a hazard. R.R.O. 1990, Reg. 851, s. 126.
3. An industrial establishment shall be adequately ventilated by either natural or mechanical means such that the atmosphere does not endanger the health and safety of workers. R.R.O. 1990, Reg. 851, s. 127.
4. (1) Replacement air shall be provided to replace air exhausted. R.R.O. 1990, Reg. 851, s. 128 (1).
   (2) The replacement air shall,
   a. be heated, when necessary, to maintain at least the minimum temperature in the workplace specified in section 129;
   b. be free from contamination with any hazardous dust, vapour, smoke, fume, mist or gas; and
   c. enter in such a manner so as,
      i. to prevent blowing of settled dust into the workplace,
      ii. to prevent interference with any exhaust system, and
      iii. not to cause undue drafts. R.R.O. 1990, Reg. 851, s. 128 (2).
   (3) The discharge of air from any exhaust system shall be in such a manner so as to prevent the return of contaminants to any workplace. R.R.O. 1990, Reg. 851, s. 128 (3).
5. (1) Subject to subsection (2), an enclosed workplace shall be at a temperature,
   a. suitable for the type of work performed; and
   b. not less than 18° Celsius. R.R.O. 1990, Reg. 851, s. 129 (1).
   (2) Clause (1) (b) does not apply to a workplace,
   a. that is normally unheated;
   b. where the necessity of opening doors makes the heating of the area to the temperature specified in clause (1) (b) impracticable;
   c. where perishable goods requiring lower temperatures are processed or stored;
   d. where radiant heating is such that a worker working in the area has the degree of comfort that would result were the area heated to the temperature specified in clause (1) (b);
   e. where the process or activity is such that the temperature specified in clause (1) (b) could cause discomfort; or
   f. during the first hour of the main operating shift where process heat provides a substantial portion of building heat. R.R.O. 1990, Reg. 851, s. 129 (2).

5.9 Lighting (OHSA Reg. 851 S.21)

1. Where natural lighting is inadequate to ensure the safety of any worker, artificial lighting shall be provided and shadows and glare shall be reduced to a minimum. R.R.O. 1990, Reg. 851, s. 21.
2. Lighting guideline
    a. 20 - 50 Lux
        i. For working in public spaces with dark surroundings
        ii. Example: Exterior inactive storage, railroad switching, outdoor substations, parking areas
    b. 50 - 100 Lux
        i. For simple orientation and short visits
        ii. Example: Interior storage, exterior pedestrian entrances, truck maneuvering areas
    c. 100 – 200 Lux
        i. For occasional visual tasks
        ii. Example: Elevators, locker rooms, exterior storage areas
    d. 200 – 500 Lux
        i. For visual tasks of high contrast or large size
        ii. Example: Reading printed material and typed originals, rough bench and machine work, ordinary inspection, rough assembly, loading docks, toilets and washrooms
    e. 500 - 1,000 Lux
        i. For visual tasks of medium contrast or small size
        ii. Example: Reading pencil writing and poorly printed or reproduced materials, medium bench and machine work, difficult inspection, medium assembly, welding, painting, active storage areas, control rooms
    f. 1,000 - 2,000 Lux
        i. For visual tasks of low contrast or very small size
        ii. Example: Reading handwriting in hard pencil on poor quality paper, very poorly reproduced material, very difficult inspection
    g. 2,000 - 5,000 Lux
        i. For visual tasks of low contrast or very small size over a prolonged period
        ii. Example: Fine assembly, very difficult inspection, fine bench, and machine work
        iii. This is the typical and recommended brightness for workstation processes at Tiercon.
    h. 5,000 - 10,000 Lux
        i. For prolonged and exciting visual tasks
        ii. Example: The most difficult inspection, extra-fine bench and machine work, extra-fine assembly
    i. 10,000 - 20,000 Lux
        i. For special visual tasks of extremely low contrast and small size
        ii. Example: Some surgical procedures

5.10 Cables, Slings, & Rigging (OHSA Reg. 213 S. 168-180)

1. (1) A cable used by a crane or similar hoisting device,
    a. Shall be steel wire rope of the type, size, grade, and construction recommended by the manufacturer of the crane or similar hoisting device;
    b. Shall be compatible with the sheaves and the drum of the crane or similar hoisting device;
    c. Shall be lubricated to prevent corrosion and wear;
    d. Shall not be spliced; and
    e. Shall have its end connections securely fastened and shall be kept with at least three full turns on the drum. O. Reg. 213/91, s. 168 (1).

    (2) No cable used by a crane or similar hoisting device,
    a. subject to subsection (3), shall contain six randomly-distributed wires that are broken in one rope lay or three or more wires that are broken in one strand in a rope lay;
    b. shall be smaller than its nominal rope diameter by more than,
        i. one millimetre for a diameter up to and including nineteen millimetres,
        ii. two millimetres for a diameter greater than nineteen millimetres up to and including twenty-nine millimetres, and
        iii. three millimetres for a diameter greater than twenty-nine millimetres;
    c. shall be worn by more than one-third of the original diameter of its outside individual wires;
    d. shall show evidence of kinking, bird-caging, corrosion or other damage resulting in distortion of the rope structure; or
    e. shall show evidence of possible rope failure including rope damage caused by contact with electricity. O. Reg. 213/91, s. 168 (2).

    (3) No cable that is static or is used for pendants,
    a. shall contain three or more broken wires in one lay or in a section between end connectors; or
    b. shall have more than one broken wire at an end connector. O. Reg. 213/91, s. 168 (3).

    (4) Rotation-resistant wire rope shall not be used for a cable for boom hoist reeving and pendants. O. Reg. 213/91, s. 168 (4).

    (5) Rotation-resistant wire rope shall not be used where an inner wire or strand for a cable is damaged or broken. O. Reg. 213/91, s. 168 (5).
2. A cable used by a crane or similar hoisting device shall be capable of supporting at least,
    a. Three and one-half times the maximum load to which it is likely to be subjected if it is used on a device other than a tower crane and its wind on a drum or passes over a sheave;
    b. Five times the maximum load to which it is likely to be subjected if it is used on a tower crane and it winds on a drum or passes over a sheave;
    c. Three times the maximum load to which it is likely to be subjected if it is a pendant or is not subject to winding or bending; and

d. Ten times the maximum load to which it is likely to be subjected if the crane or similar hoisting device is used for supporting persons. O. Reg. 213/91, s. 169.

3. (1) All cable used by a crane or similar hoisting device shall be visually inspected by a competent worker at least once a week when the crane or similar hoisting device is being used. O. Reg. 213/91, s. 170 (1).
   (2) The worker performing an inspection shall record the condition of the rope or cable inspected in the log book for the crane or similar hoisting device. O. Reg. 213/91, s. 170 (2).
4. (1) A cable used by a crane or similar hoisting device shall be securely attached,
   a. By binding and fastening the cable around an oval thimble in a way that is strong enough to prevent the cable thimble from separating; or
   b. By fastening the cable within either a tapered socket by means of virgin zinc or a wedge-type socket fitted with a wire rope clip at the dead end to prevent the accidental release or loosening of the wedge. O. Reg. 213/91, s. 171 (1).
   (2) The dead end cable of a wedge socket assembly on a hoisting line shall extend between 100mm and 300mm out of the socket. O. Reg. 213/91, s. 171 (2).
5. (1) A container, sling or similar device for rigging or hoisting an object, including its fittings and attachments,
   a. Shall be suitable for its intended use;
   b. Shall be suitable for and capable of supporting the object being rigged or hoisted;
   c. Shall be so arranged as to prevent the object or any part of the object from slipping or falling;
   d. Shall be capable of supporting at least five times the maximum load to which it may be subjected; and
   e. Shall be capable of supporting at least ten times the load to which it may be subjected if it is to be used to support a person. O. Reg. 213/91, s. 172 (1).
   (2) A sling or similar device made of web-type fabric or nylon shall be labelled to indicate its load rating capacity. O. Reg. 213/91, s. 172 (2).
   (3) No sling or similar device for rigging or hoisting made of web-type fabric or nylon shall be used if it may be cut. O. Reg. 213/91, s. 172 (3).
6. (1) Every hoisting hook shall be equipped with a safety catch. O. Reg. 213/91, s. 173 (1).
   (2) No safety catch is required on a hoisting hook used in placing structural members if the method of placing protects workers to the same standard as a safety catch does. O. Reg. 213/91, s. 173 (2).
   (3) A hoisting hook shall have its load rating legibly cast or stamped on it in a location where the person using the hook can readily see it. O. Reg. 213/91, s. 173 (3).
   (4) A hoisting hook shall not be used if it is cracked, has a throat opening that is greater than as manufactured or is twisted from the plan of the unbent hook. O. Reg. 213/91, s. 173 (4)
7. A hook block shall have its load rating and weight legibly cast or stamped on it in a conspicuous location. O. Reg. 213/91, s. 174.
8. (1) An overhauling weight used on the cable of a crane or similar hoisting device
   a. Shall be prevented from sliding up or down the cable; and

b. Shall be securely attached to the load hook and the cable. O. Reg. 213/91, s. 175 (1).

(2) No overhauling weight used on the cable of a crane or similar hoisting device shall be split. O. Reg. 213/91, s. 175 (2).

9. (1) Only an alloy steel chain or a chain manufactured for the purpose shall be used for hoisting. O. Reg. 213/91, s. 176.
   (2) No alloy steel chain shall be annealed or welded. O. Reg. 345/15, s. 20.
   (3) A chain used for hoisting shall,
   a. be labelled to indicate its load rating capacity;
   b. be repaired and reconditioned in accordance with the specifications of its manufacturer;
   c. after being repaired or reconditioned, be proof tested in accordance with the specifications of its manufacturer; and
   d. be visually inspected by a competent worker as frequently as recommended by its manufacturer and, in any case, at least once a week when the chain is in service. O. Reg. 345/15, s. 20.
10. A friction-type clamp used in hoisting materials shall be constructed so that an accidental slackening of the hoisting cable does not release the clamp. O. Reg. 213/91, s. 178.
11. (1) If a worker may be endangered by the rotation or uncontrolled motion of a load being hoisted by a crane or similar hoisting device, one or more guide ropes or tag lines shall be used to prevent the rotation or uncontrolled motion. O. Reg. 213/91, s. 179 (1).
    (2) No guide rope or tag line shall be removed from a load referred to in subsection (1) until the load is landed and there is no danger of it tipping, collapsing or rolling. O. Reg. 213/91, s. 179 (2).
12. (1) Piles and sheet-piling shall be adequately supported to prevent their uncontrolled movement while they are being hoisted, placed, removed or withdrawn. O. Reg. 213/91, s. 180 (1).
    (2) No worker shall be in an area where piles or sheet-piling are being hoisted, placed, removed or withdrawn unless the worker is directly engaged in the operation. O. Reg. 213/91, s. 180 (2).

5.11. Laser Safety (OHSA) (ANSI Z136.1 CAN/CSA-E60825-1:03)

1. All sensors/light emitting sensor light emitting sensors listed below or not listed below must :

   a. Not emit light outside of the equipment envelope into surrounding areas.
   b. If the required functionality of the sensor is prohibited due to its location base on A, the sensor must only be operational (powered) while the equipment is not in cycle.
   c. All of other methods of preventing A, must be approved by Tiercon Corp. during design and testing phases.
   d. Suppliers to provide adequate, permanent signage visible to all similar verbiage as follows:

"Laser *radiation. Do not stare into beam. Class 2 laser product"* or
"Laser *Radiation. Do not stare into beam or view directly with optical instruments. Class 2 laser product* "

6.0 REFERENCES

1. Pre-start Health and Safety Reviews (OHSA Reg. 851 S.7)
    a. Exposure Limit (OHSA Reg. 833)
    b. Designated Substance – Asbestos (OHSA Reg. 278/05)
    c. Designated Substances (OHSA Reg. 490/09)
2. Premises (OHSA Reg. 851 S.12-14)
3. Machine Guarding (OHSA Reg. 851 S.24-44.2)
    a. Safeguarding of Machinery (CSA Z432-16)
4. Control of hazardous energy – Lockout and other methods (CSA Z460-13)
5. Musculoskeletal Disorders Prevention Program Standards (EHSP-201)
6. Noise (OHSA Reg. 381 S.2)
7. Industrial Hygiene (OHSA Reg. 851 S.128)
8. Lighting (OHSA Reg. 851 S.21)
    a. Emergency lighting equipment (CSA C22.2 No. 141-15)
9. Cables, Slings, & Rigging (OHSA Reg. 213 S. 168-180)
    a. Health and safety code for suspended equipment operations (CSA Z91-17)
10. Industrial robots and robot systems (CSA Z434-14)
11. Safety standard for lift trucks (CSA B335-15)
12. Industrial Control Equipment (CSA C22.2 No. 14-18)
13. Electrical Interface between Injection Moulding Machine and Handling Device/Robot (EUROMAP 67)
14. The Canadian Standards Association
15. The Electrical Safety Authority (Electricity Act, 1998)
16. Regulations (OSHA Standards – 29 CFR)
17. General Industry Safety and Health Standards (MIOSHA)
18. Building Code Act (1992)
19. Fire Protection and Prevention Act (1997)
20. Canadian Centre for Occupational Health and Safety (CCOHS)
21. ANSI Z136.1 Safe Use of Lasers
22. CAN/CSA-E60825-1:03 Safety of Laser Products
23. Conveyor Standards of Requirements (EHSP-204)

7.0 REVISION HISTORY

Revision	Prepared By	Approved By	Date	Changes
0	V. Yuan	A. Tassone	13-02-2020	Initial creation
1	B. Yap	A. Tassone	26-10-2022	Changeover to doc. control format; addition of ergonomic criteria;

				update of O. Reg
2	A. Tassone	C. George	13-02-2023	Added Sec. 5.11. Laser Safety and updated references