

Workplace Safety and Health Guidelines

Tent-related Works



WSHCOUNCIL

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1. Introduction

Tents are familiar sights in Singapore. They come in various shapes and sizes and are often used during outdoor events such as road shows and carnivals. See Figure 1 for side profiles of tents that are commonly seen in Singapore.

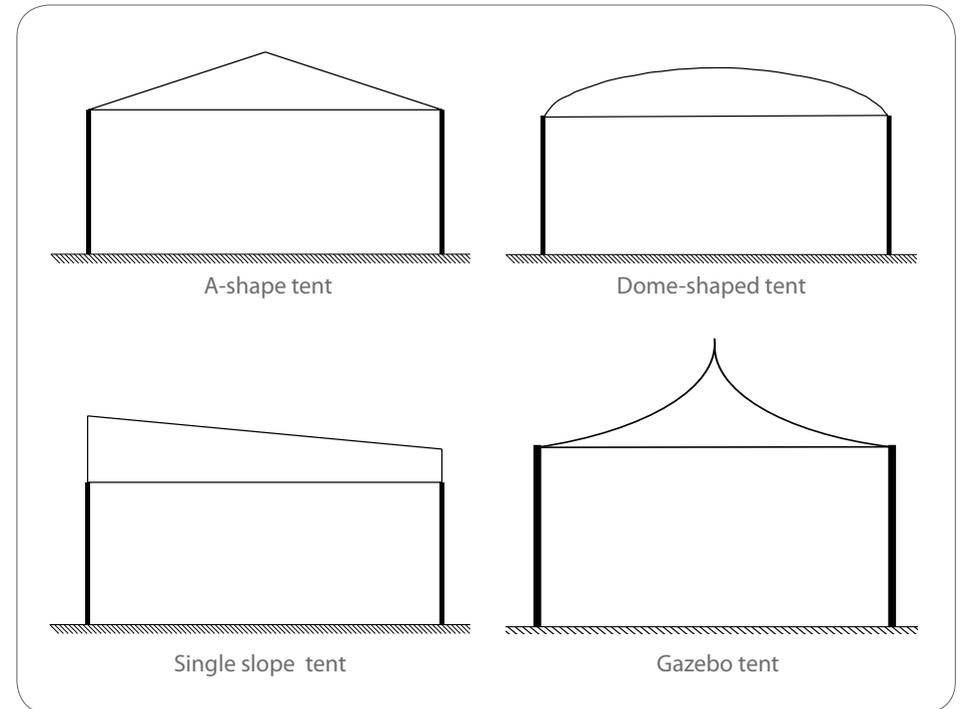


Figure 1: Side profiles of common tent shapes in Singapore.

The workplace safety and health (WSH) of workers and all relevant stakeholders (e.g., public) must be taken into consideration when handling, erecting and dismantling such tents.

Physical hazards such as working at heights and struck by falling objects can potentially injure workers. However, the health and wellbeing aspect should not be overlooked because very often, tent workers are subjected to health-related hazards such as fatigue and heat stress.

It is therefore important to address all tents-related hazards in a holistic, safe and healthy manner.

1.1 Classification of Tents

Tents available in Singapore are broadly classified into two major types—traditional and engineered tents. See Sections 1.1.1 and 1.1.2 for a brief introduction to each type of tents. A more detailed comparison between traditional and engineered tents can be found in Annex A.

1.1.1 Traditional Tents

Traditional tents are commonly used in Singapore for more than 30 years. Such tents are mostly manufactured locally. The main components of traditional tents are tent structure and canopy. The tent structure is made up of steel frames that are assembled with bolts and nuts. The tent canopy, also known as canvas sheet, is commonly made of polyethylene (PE) and has to be manually tied to the tent structure. The erection and dismantling methods of traditional tents are typically imparted through on-the-job training and refined through accumulation of hands-on experience.

1.1.2 Engineered Tents

Many local tent companies have started to offer engineered tents to slowly replace traditional tents. Such tents are manufactured according to international standards. The tent frame members, which are usually made of aluminium alloy, are designed for quick and easy assembly on the ground. The tent canopy, also known as tent membrane, is commonly made of polyester fabric coated with polyvinyl chloride (PVC) with auto-slot mechanism that is designed to remove the need to manually tie the tent canopy to the tent structure.

Engineered tents are designed to be erected in a systematic manner with step-by-step procedures. These procedures can be used as part of workers' training material.

1.2 Scope and Application

This publication specifies the recommended practices for both traditional and engineered tent-related works. Key work activities include, but are not limited to, warehouse storage, transportation of materials, erecting and dismantling of tent structures and handling of electrical installations.

This publication also aims to raise WSH awareness of stakeholders (e.g., tent service buyers, contractors and workers) in the tent sector.

Additional WSH resources for the tent sector can be found in the Annex:

- Tentage safety checklist (see Annex B)
- Five Golden Safety Rules (see Annex C)

1.3 Relevant Legislation

The following legislations are relevant to the tent sector (non-exhaustive list) in Singapore:

S/No.	Authority	Legislation Title	Application
1	Ministry of Manpower (MOM)	WSH Act and its subsidiary legislation	States the requirements for ensuring the safety and health of workers and other people (including visitors and public) who are affected by the work being carried out.
		Work Injury Compensation Act	States the amount of compensation an employee will receive (if he or she is injured at work) and the amount the employer will be liable to pay.
2	Building and Construction Authority (BCA)	Building Control (Temporary Buildings) Regulations	States the requirements for structures that are classified as temporary buildings. To erect a temporary building, a permit has to be applied through BCA.
3	Singapore Civil Defence Force (SCDF)	Fire Safety Act – Temporary Change of Use Permit	Depending on the tent size, event duration and event type, a temporary change of use permit may be applied from SCDF if a temporary or makeshift structure is to be setup outdoors.
4	Land Transport Authority (LTA)	Rapid Transit Systems (Railway Protection, Restricted Activities) Regulations	Approval may be required from LTA - Development and Building Control (DBC) before temporary structures are to be erected near or within areas classified as railway safety zones. For more information, refer to <i>Guide to Carrying Out Restricted Activities within Railway Protection and Safety Zones</i> .

Table 1: Legislations relevant to the tent sector.

Other than the legislations listed in Table 1, depending on the location required for tent set up, approval for use of land has to be sought by applying through relevant authorities or bodies such as Town Councils, Community Centres (CCs), Housing Development Board (HDB) and Singapore Land Authority (SLA).

2. Risk Management

Risk management (RM) should consist of the process of preparation, risk assessment, risk control implementation, record-keeping, review and continual communication (see Figure 2). Risk assessment (RA) is a key component of RM. If the control measures identified in the RA are implemented appropriately, it will reduce risks at work.

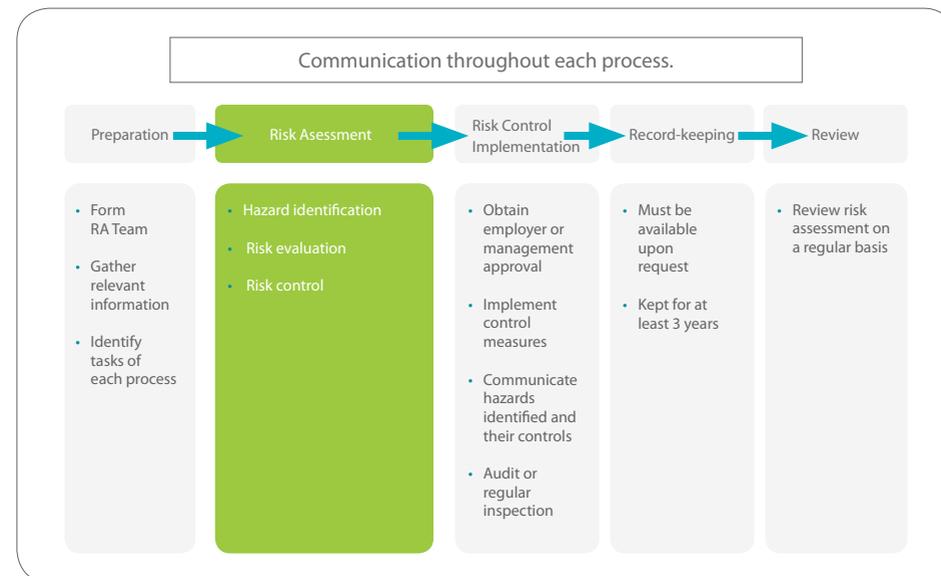


Figure 2: The Risk Management Process.

2.1 Risk Assessment

Under the WSH (Risk Management) Regulations, every workplace must conduct RA for all routine and non-routine work. Workplace risks can then be assessed in three simple steps:

STEP 1: Hazard Identification

Hazards associated with the activity of each work process are determined in this step, along with the potential accidents or ill-health that could result from these hazards. It also identifies the person(s) who may be at risk as a result of being exposed to these hazards.

STEP 2: Risk Evaluation

Risk evaluation is the process of estimating the risk levels of the identified hazards and their acceptability. Risk evaluation is made up of two parts:

- estimating the *severity* of the hazard; and
- estimating the *likelihood* of the incident or ill-health occurring with the existing risk controls.

STEP 3: Risk Control

Based on the outcome of risk evaluation in STEP 2, risk controls should then be selected to reduce or confine the identified risk to an acceptable level.

These risk controls should be effective yet practicable. To control hazards and reduce risks, control measures should be observed in accordance with the Hierarchy of Control (see Figure 3).

Hierarchy of Control

Control measures in the Hierarchy of Control are ranked in order of effectiveness. As far as possible, priority should be given to upstream risk control measures.

It may be necessary to use more than one risk control measure to reduce risks to the lowest possible level when no single measure is sufficient on its own. For example, engineering controls, such as using safer equipment, can be implemented together with administrative controls, such as training and safe work procedures (SWPs), to reduce a workplace risk.

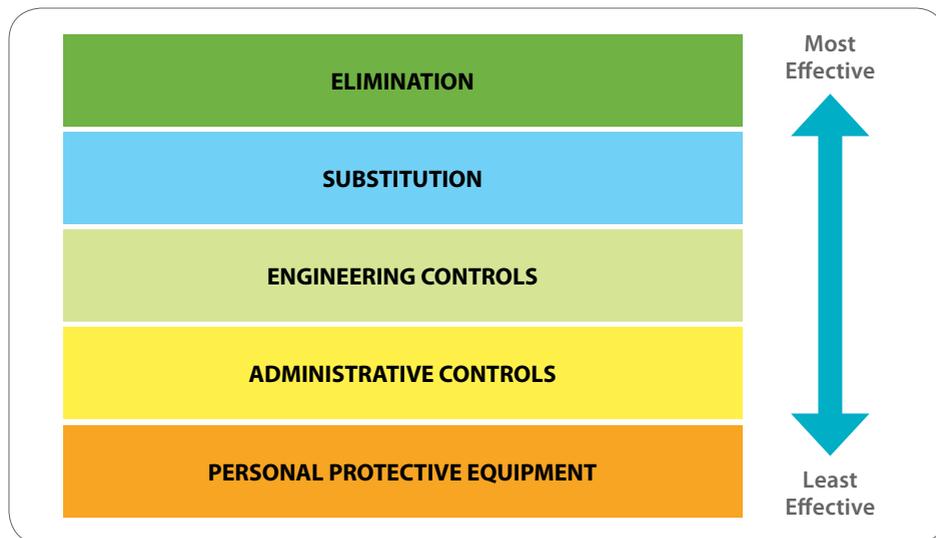


Figure 3: The Hierarchy of Control.

Elimination

Elimination of risk refers to the removal of a worker's exposure to the hazards, effectively making all identified possible accidents and ill-health impossible. As elimination is the most effective method of risk control, it should be considered first. Also, once eliminated, the risk should not appear in subsequent RA forms. For example, when heavy objects are stored on top shelves, they create uneven load distribution which may lead to shelf collapse injuring workers working near them. This hazard can be effectively eliminated by storing heavier objects at the bottom of the shelf and lighter ones on top.

Substitution

This involves replacing a hazard with one that presents a lower risk. For example, instead of using a conventional A-frame ladder, one can replace it with a mobile step platform which is a more stable option. Although using a mobile step platform does not remove falling from heights hazards, the risk is significantly reduced.

Engineering Controls

Engineering controls are physical means that limit the hazard. These include structural changes to the work environment or work processes. Examples include the use of engineered tents to replace traditional tents or the use of gazebo tents to replace single-sloped traditional tents. Both engineered and gazebo tents can be assembled on the ground and reduce the need to work at heights by 40%.

Administrative Controls

These controls reduce or eliminate exposure to a hazard by adherence to procedures or instructions. Documentation should emphasise all steps in the work processes and all controls needed for work activities to be carried out safely. For example, when setting up tents at public areas, it is recommended to barricade the work zone and put up sufficient warning signs to prevent the public from entering.

Personal Protective Equipment

Proper use of personal protective equipment (PPE) can help keep workers safe at work. However, PPE should only be used in addition to other control measures (e.g., engineering control measures) or when all other measures are not feasible or practical. For PPE to be effective, it must be properly worn at all times when the user is exposed to the hazards and must fit the user correctly. PPE must also be cleaned and maintained regularly and stored in an appropriate place when not in use.

For more information regarding RM and RA, see *Code of Practice on Workplace Safety and Health (WSH) Risk Management*.

3. Roles and Responsibilities

Stakeholders relevant to the tent sector are:

- tent service buyers;
- tent contractors; and
- tent workers.

3.1 Tent Service Buyers

Tent service buyers take on the role of a principal. A principal is any person who engages another person or organisation to supply labour or perform work under some arrangement otherwise than a contract of service.

The main responsibilities of a tent service buyer are to ensure that the appointed tent contractor:

- Has obtained the necessary licences, permits, certificates or any other approval document before performing the relevant works;
- Has conducted RA and implemented the necessary safety measures for the works to be performed;
- Has provided tent workers with sufficient information and training (including mandatory, WSH-related and trade-specific competencies) so that they are able to perform the work in a safe and proper manner; and
- Provides adequate work supervision for the tent works being carried out.

3.2 Tent Contractors

Tent contractors take on the role of an employer. An employer is any person who employs another person to perform work under a contract of service.

The main responsibilities of a tent contractor are:

- Ensure that all foreseeable hazards are identified and control measures implemented to eliminate or mitigate the risks through the RM process;
- Ensure the safety and health of all employees, visitors and the public;
- Develop and implement SWPs for work activities related to tent works;
- Inform all employees of the workplace hazards and ensure that safety and health rules and SWPs are adhered to;
- Provide adequate work supervision;
- Provide proper and sufficient PPE or any other safety equipment for the work being carried out;
- Ensure that all employees are adequately trained and competent to carry out their works;

- Ensure that all accidents, near misses, equipment failure or damage are mitigated, reported and documented; and
- Establish emergency procedures and provide all necessary emergency equipment or facilities such as fire extinguishers and first aid kits.

3.3 Tent Workers

Tent workers take on the role of a person at work. A person at work, including an employee, that is one employed under a contract of service or any other person training or working under the employer.

The main responsibilities of a worker are:

- Follow workplace instructions, safety warnings and signage at the workplace;
- Observe SWPs at all times;
- Use all safety devices and PPE as required;
- Attend safety and health training or briefing sessions;
- Operate equipment only if they hold valid licences, possess the relevant safety certification and have been given the authorisation to do so;
- Operate equipment (including vehicles) safely and do not use them beyond their capacity or designated purpose;
- Never misuse, interfere with or modify any of the equipment or safety device;
- Report any damage, malfunction or suspected defect of equipment, safety device or PPE to supervisor;
- Report accidents, incidents, diseases and any workplace hazards to supervisor or person-in-charge; and
- Suggest ways to improve WSH standards or identify any lapses during work.

For more information on the roles and responsibilities of relevant stakeholders, see Workplace Safety and Health Act (Chapter 354A).

4. Tent-related Activities and WSH Concerns

Key activities within the tent sector can be categorised into two stages (see Figure 4):

1. Pre- and post-job activity logistics; and
2. On-site operations.

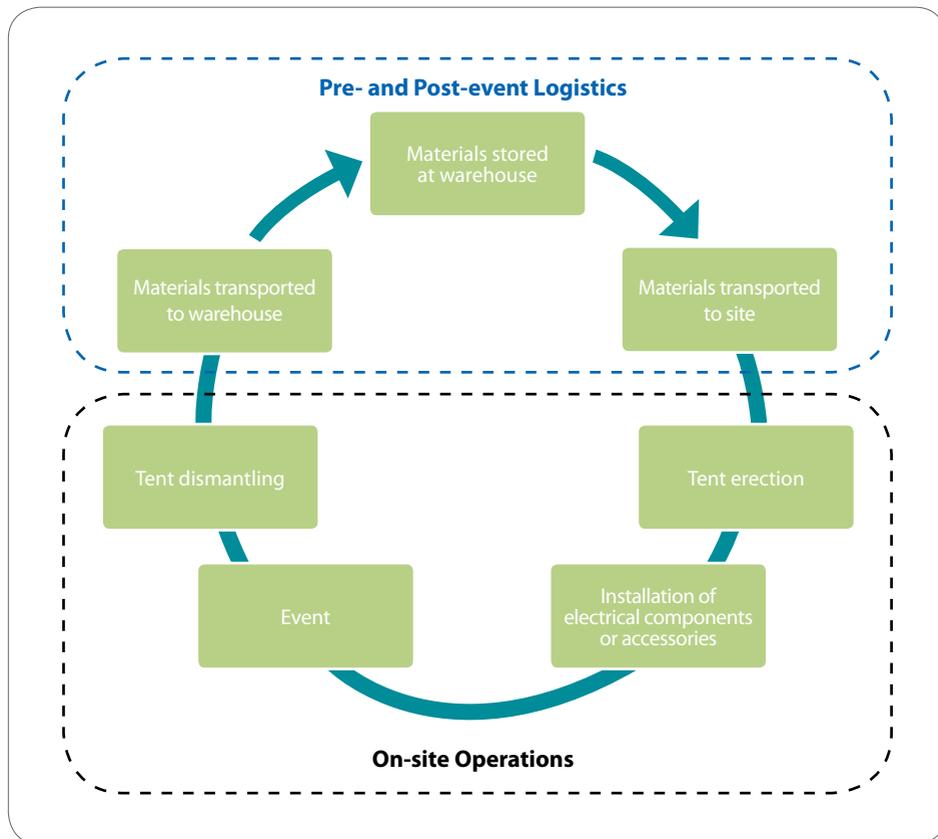


Figure 4: Typical work flow for tent-related works.

4.1 Pre- and Post-event Logistics

S/No.	Activities	WSH Concerns
1	Storing of materials	<ul style="list-style-type: none"> • Warehouse layout • Usage and management of warehouse racks • Storage methods • Housekeeping • Lighting
2	Moving materials within the warehouse	<ul style="list-style-type: none"> • Forklift operations
3	Carrying, pulling or pushing of heavy materials	<ul style="list-style-type: none"> • Forceful exertions • Awkward postures • Repetitive movements
4	Transporting of materials to and from work site	<ul style="list-style-type: none"> • Loading and unloading of materials

Table 2: Pre and post-event logistics and their respective WSH concerns.

See Section 5 for more information on WSH concerns for pre- and post-event logistics.

4.2 On-site Operations

S/No.	Activities	WSH Concerns
1	Erecting and dismantling of tent	<ul style="list-style-type: none"> Public or visitors Working at heights Use of ladders
2	Lifting of tent frame members	<ul style="list-style-type: none"> Lifting operations Use of Mobile Elevated Working Platforms (MEWPs) Use of scaffolds
3	Assembly of tent structure	<ul style="list-style-type: none"> Use of hand tools
4	Working outdoors	<ul style="list-style-type: none"> Weather conditions Heat stress Fatigue
5	Electrical works	<ul style="list-style-type: none"> Handling mobile generators Handling other electrical components

Table 3: On-site operations and their respective WSH concerns.

See Section 6 for more information on WSH concerns for on-site operations.

5. Risk Control Measures for Pre- and Post-event Logistics

5.1 Warehouse Layout

Most tent companies have storage facilities for tent components and materials. Operationally, they may be required to move large quantities of material in and out of the warehouse frequently. Poor layout of such facilities can affect daily operations and increase the likelihood of accidents occurring. The basic objective when planning for a factory layout is to ensure a safe and smooth flow of people, work and material.

Some factors to consider when planning for factory layout are:

- physical safety (e.g., a safe means of access and egress for all work areas, clear traffic demarcation);
- health (e.g., ensure sufficient ventilation at all work areas); and
- welfare (e.g., provision of sufficient first-aid resources).

More information about factory layout can be found in the following Singapore Standards:

- SS 567 : 2011 Code of Practice for Factory Layout – Safety, health and welfare considerations

5.2 Usage and Management of Warehouse Racks

Tent companies require warehouse racks for organising inventory and storing equipment and components. All storage racks should be designed for safe use and maintenance. The collapse of such racks can lead to fatal accidents. Some recommendations regarding the safe management and usage of warehouse racks are listed below.

Safe Storage

- Storage racks should be structurally stable and designed for the nature of goods (e.g., weight, volume, shape, dimensions) to be stored. Load capacity should be calculated and the safe working load should be prominently displayed. In particular, if storage racks are stacked, the lower racks must be sufficiently designed to bear the weight of the upper racks and their corresponding goods.
- Consider warehouse storage solutions that provide safe storage and safe access to the goods being stored.
- For better stability, larger and heavier objects should be stored on lower racks and lighter and smaller objects on the higher racks.

Safe Work Procedures

- Determine the combined weight of load to be stored prior to loading and confirm that the safe working load of the rack in use is not exceeded. The installation of load capacity signs on each rack is recommended.
- Ensure that weight of load is evenly distributed by evenly stacking it across the rack. This is important as uneven loading can affect the stability of the racking system.
- Ensure that warehouse personnel are trained on the safe work method for transferring goods to and from the storage system.
- Ensure that only qualified and competent workers (such as licensed forklift drivers) are allowed to perform specific tasks.

Regular Inspections

- Regular site checks should be conducted to ensure that:
 - SWPs are adhered to; and
 - Warehouse racks and pallets are used properly and not over-stacked or over-loaded.
- Storage equipment (including racks and pallets) must be subjected to thorough professional assessment to ensure that they remain free of defects (e.g., no signs of damage or corrosion) and that there is no threat to its structural integrity. Any parts found with defects must be repaired or replaced with original manufacturer-supplied parts as soon as possible.
- If the storage equipment is exposed to dampness, it is important that they are provided with suitable corrosion protection so that its structural integrity will not be compromised.

5.3 Storage Methods

Poor storage methods can be hazardous. For example, loose items not secured properly may be dislodged during retrieval of items or from unintentional bumping against the racks or shelves. The safe maximum load of shelving or racks should be strictly adhered to at all times.

Before transporting equipment or components from the warehouse to site, a thorough inspection for visible defects should be conducted. Inspection items may include, but are not limited to, tent canopy, tent frame members, hand tools and electrical installations. This will reduce the need for repair or reworking of tents on site.

5.3.1 Storage of Heavier Items on Lower Shelves or Racks

In general, heavier items should be placed on lower storage racks or shelves and lighter items on the higher ones. In this way, the rack would be more stable and less likely to topple.

5.3.2 Securing Items for Safe Storage

Netting or restraining bars can be used to secure goods or items or to keep them in place to prevent unwanted movement during storage.

5.3.3 Storage of Irregularly Shaped Items

Tent companies handle many irregularly shaped items. Some examples are ladders, long tent frame members and electrical components. Storage of such irregular shaped items can be challenging and hazardous if not managed properly.

Ensure the following for proper storage of irregularly shaped items:

- Items of the same type and size should be stored together. Where appropriate, they can be secured together by using materials such as ropes or shrink wrap. For example, frame members of similar or same dimensions should be securely bundled together;
- Items such as tent canopy should be properly and securely tied together before they are being stacked on racks. This can help to prevent unwanted movement; and
- Small, loose items (e.g., hand tools, electrical components, etc) should be tied together, wrapped or kept in containers.

5.4 Housekeeping

Good housekeeping can get rid of many workplace hazards and help get a job done safely and efficiently. Poor housekeeping, on the other hand, can contribute to accidents such as slips, trips and falls and struck by falling objects.

The Japanese 5'S' Workplace Organisational Method can be adopted to carry out effective housekeeping at the workplace. Each of the 5'S' is reflected in Table 4.

S/No.	5'S'	Description	Remarks
1	Sorting	Separate necessary from unnecessary items and remove the unnecessary ones.	Frequent visual checks should be conducted to ensure that all tent components are free of defects and in good working condition. Damaged components should be repaired or replaced immediately. Such visual checks should also determine other items that are unnecessary so that they can be disposed off appropriately.
2	Straightening	Organise a better workflow and store items for easy retrieval.	Identical or similar items should be stored together in the same location. Planning may be required to clearly label all racks. Clear labelling of racks can facilitate easy storage and retrieval.
3	Shining	Keep workplace clean, tidy and in good condition.	Keep warehouse neat and tidy by ensuring that there are no loose items lying around on the ground. Ensure that there is proper passageway for humans and vehicles.

4	Standardising	Create standards to make “Sort”, “Straighten” and “Shine” a habit.	Ensure that the above mentioned are carried out at a pre-determined frequency. Assign duties to relevant personnel to execute the “Sort”, “Straighten” and “Shine” process.
5	Sustaining	Maintain the standard and implement initiatives to sustain 5'S' activities.	Engage employees to educate them on the importance and benefits of 5'S'. Implement an internal audit system for the 5'S' system.

Table 4: 5'S' Workplace Organisational Method.

5.5 Lighting

Poor lighting at the workplace makes it difficult for employees to see and this can lead to visual fatigue and discomfort. Proper lighting, on the other hand, creates a pleasant atmosphere and gives workers a sense of well-being. Lighting in the workplace should allow employees to comfortably carry out their tasks. This improves their productivity and efficiency and prevents accidents and costly errors.

5.5.1 Warehouse Lighting

In the warehouse, it is important to provide:

- adequate lighting in the general warehouse environment; and
- additional task lighting in specific parts of the warehouse may be required for special tasks such as performing maintenance works.

5.5.2 Night Works

Workers carrying out works at night are exposed to a higher risk of injury mainly due to reduced visibility and working against their natural sleep cycle. The following good practices are recommended when there is a need to carry out night works:

- Provide reflective clothing for all site personnel;
- Provide proper work area lighting such as lighting towers (see Figure 5);
- Brief all site personnel on their assigned work area(s) and relevant hazards;
- Provide clear signage or traffic cones when working near roads; and
- Provide more breaks.



Figure 5: Example of a lighting tower.

More information about workplace lighting can be found in the following Singapore Standards:

- SS 531: Code of Practice for Lighting of work places, Part 1: Indoor;
- SS 531: Code of Practice for Lighting of work places, Part 2: Outdoor; and
- SS 531: Code of Practice for Lighting of work places, Part 3: Lighting Requirements for Safety and Security of outdoor work places.

5.6 Forklift Operations

Tent companies often use forklifts to lift and transport materials. However, forklifts can be dangerous when they are operated recklessly. Forklift operators play a crucial role in ensuring his safety and the safety of those in the vicinity. Only forklift drivers who are trained and have passed the Workforce Skills Qualifications (WSQ) “Operate Forklift” course are allowed to operate forklifts. Ensuring that forklifts are maintained according to manufacturers’ recommendations are of equal importance. See Figure 6 for a summary of good practices when using a forklift.

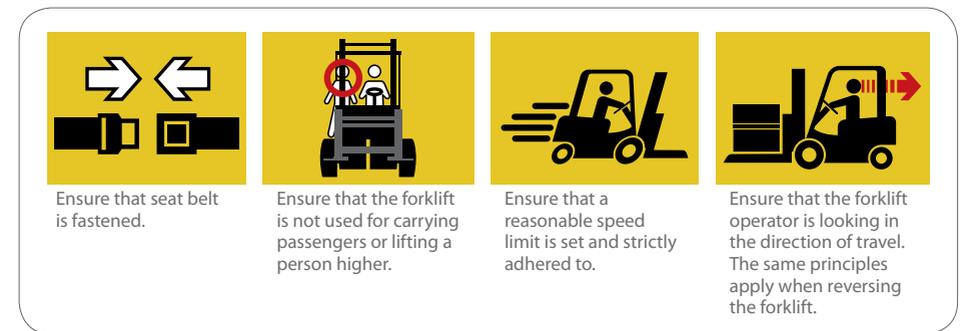


Figure 6: Forklift good practices.

5.6.1 Irregular Loads

Tent companies often use forklifts to transport irregular shape loads (e.g., long tent frame members). The more irregular the shape of the load, the higher the chances of it falling during the transportation process. When transporting irregular-sized load, RA has to be conducted taking into account the safe movement of the irregular-sized load. Such loads need to rest on the forks in a stable manner and they should be properly secured before the forklift moves.

For more information on forklift safety, see *WSH Guidelines on Safe Operation of Forklift Trucks*.

5.7 Forceful Exertions

Workers in the tent sector often have to forcefully exert themselves to lift, carry, push or pull heavy loads. Handling heavy loads below the waist level or above the shoulders puts a strain on the back. Frequently carrying heavy loads or carrying heavy loads over long distances may further increase the chances of back injuries.

Good practices for handling heavy loads:

- Ensure that heavier objects are stored on shelves at waist level if these objects are frequently handled;
- Provide mechanical aids and tools to lift or move heavy objects (e.g., trolleys);
- Encourage buddy system to lift or move heavy objects;
- Use correct lifting techniques (e.g., keep back straight);
- Encourage workers to slide, roll or push heavy objects instead of carrying them; and
- Provide appropriate footwear to prevent slips, trips and falls.

For more information on good working postures, see *WSH Guidelines on Improving Ergonomics in the Workplace*.

5.8 Awkward Postures

An awkward posture is one where the position of the body, arms and legs deviate greatly from their natural relaxed position. Work which requires holding awkward positions for long hours or high frequency can stress muscles, joints or tendons can result in aches and pains in affected body parts.

Good practices to reduce awkward postures:

- Provide adjustable equipment to reduce the need to stretch or reach for things;
- Provide ergonomically designed hand tools; and
- Consider storing bulky and/ or heavy items on shelves near waist level for easier retrieval because this will reduce the need to stretch above the elbow or over the head.

For more information on good working postures, see *WSH Guidelines on Improving Ergonomics in the Workplace*.

5.9 Repetitive Movements

Repetitive movements can become hazardous when the same action is repeated too often over an extended time period. Injuries occur when too much stress is placed on the same set of muscles, joints or tendons repeatedly without providing sufficient recovery time. The risk of injury increases with the amount of force required. The body needs to rest to recover, and more rest time should be given after intensive work activities. Some common highly repetitive activities include handling canvas sheet and packing items.

Good practices to mitigate risks from repetitive movements:

- Plan work schedules to include adequate short breaks;
- Encourage employees to do simple stretching exercises routinely to relax working muscles; and
- Arrange job rotations to ensure a different set of muscles is used for each work activity.

For more information on repetitive movements, see *WSH Guidelines on Improving Ergonomics in the Workplace*.

5.10 Loading and Unloading of Materials

To ensure safe loading onto and unloading from vehicles, the operation should be carried out at a designated area such as a loading or an unloading bay or a clearly demarcated and designated area meant for loading and unloading. The driver should follow relevant safe operating instructions laid out in the operation manual of the respective transport vehicles.

STEP 1: Parking of vehicle

- Ensure that vehicle is parked on firm and level ground; and
- Ensure that parking brakes are engaged and all stabilisers or wheel chocks are properly positioned.

STEP 2: Loading

- Ensure that the right vehicle is chosen for the intended load;
- Ensure that the vehicle is not overloaded;
- Ensure that the weight of load is evenly spread out as far as possible. Uneven distribution of weight may render the vehicle unstable; and
- Loads must be suitably secured.

STEP 3: Unloading

- Before unloading, make sure that the loads have not shifted during transportation. It is also crucial to ensure that the loads will not move or slide when restraints are removed before unloading.

For more information on safe loading, see *WSH Guidelines on Safe Loading on Vehicles*.

6. Risk Control Measures for On-site Operations

6.1 Public or Visitors

The safety and health of workers is just as important as the safety and health of visitors and passers-by. For on-site operations, tents are often erected in public areas. Passers-by in the vicinity may be exposed to workplace hazards such as struck by falling objects.

When carrying out tent-related activities in public areas, ensure that:

- Sufficient and visible warning signs are effectively put in place;
- Work zones are effectively barricaded to prevent unauthorised entry; and
- Sufficient PPE (e.g., safety helmets) are provided for visitors.

6.2 Working at Heights

Tent workers may be required to work at heights during erecting and dismantling of tents. Work activities carried out on top of tents may include (but not limited to) installation of purlins (tent members that support the tent canopy), and laying and tying of tent canopy. Such activities put the workers at high risk of falling from heights accidents that can result in deaths or serious injury. See Table 5 for examples of high risk activities involving work at heights.

S/No.	Work Activities	Suggested Solutions
1	 <p>Tent workers installing purlins unsafely.</p>	 <p>Use a “prong-like” lifting rod device (see image below) to raise the purlins to the desired height and position. In this way, workers can work from ground level when installing purlins.</p>

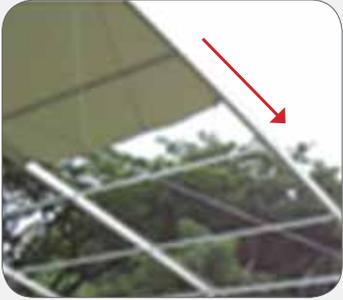
2	 <p>Tent workers laying tent canopy unsafely.</p>	 <p>Some form of redesign may be required. One may consider installing the railings onto the tent frame members (see image below). The edges of the tent canopy are also required to be redesigned so that they can be slotted into the railings. In this way, workers are not required to work on top of tent structures.</p>
3	 <p>Tent workers tying canvas sheet unsafely.</p>	<p>If the railings and canvas sheets are redesigned as described in point 2, then workers are not required to go on top of tent structure to tie the tent canopy.</p>

Table 5: Photos of workers erecting traditional tents.

The tents shown in Table 5 are traditional tents. Traditional tent structures require tent workers to work at heights without proper fall prevention or protection measures. In comparison, engineered tents eliminate the need for workers to work on tent structures. See Annex A for a comparison of traditional and engineered tents.

6.3 Use of Ladders

Ladders are frequently used by tent companies. Ladders may be needed when installing fans, lighting and inner lining. Other than choosing the right ladder for the intended task, it is also important to ensure that it is safe for use. A “pre-use” check should be conducted to look out for any visible defects on the ladder and ensure that it is in a good working condition. Some reminders regarding safe use of ladders are listed in Figure 7.

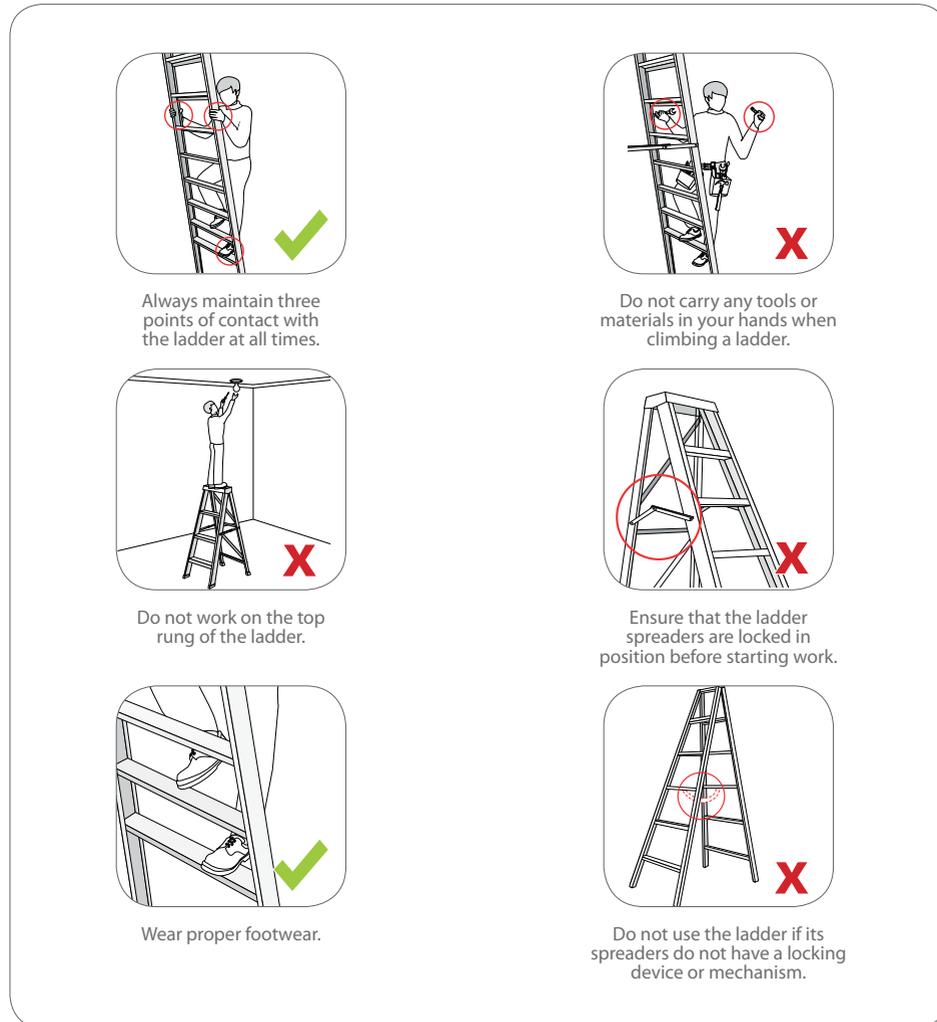


Figure 7: Recommendations on the safe use of ladders.

For more information on safe use of ladders, see *Ladder Safety Guide*.

6.4 Lifting Operations

Lifting operations need to be carried out during some of the activities such as erecting and dismantling of tents. Every lift has a set of risks that needs to be managed in order to prevent an accident from occurring. Unsafe lifting operations may result in catastrophic outcomes involving multiple deaths and serious injuries in addition to extensive damage to properties and facilities.

When carrying out crane lifting operations, ensure that:

- it is operated by a qualified and competent person;
- the lifting gear is in a good working condition and possesses valid certification;
- the load is properly rigged before lifting; and
- the load is within permissible limits according to the load chart.

6.4.1 Lorry Cranes

Lorry cranes are commonly used by tent companies (see Figure 8). Some recommended good practices regarding the use of lorry cranes are listed below.

- Operator must possess a valid training certificate after completing the Lorry Crane Operator Course;
- Ensure that the lorry crane has a valid Certificate of Test and Examination issued by an Authorised Examiner;
- Always check the load chart and identify the safe working load of the lorry crane;
- Ensure that daily pre-operational checks are conducted at the start of every shift on all limiting and indicating devices under no load conditions. Record and keep the test results;
- Ensure that the lifting plan has been established and entire lifting team has been briefed on the plan by the lifting supervisor;
- Check ground condition to make sure that it is safe for travelling and lifting before any lifting operation;
- Ensure that the outriggers are fully extended and set up on firm and level ground;
- Crane must not be left unattended while load is suspended in mid-air;
- Ensure that crane is not used to pull or drag any load;
- Ensure that the boom and outriggers of the lorry crane are not extended when travelling on the road;
- Ensure that the crane is not operated under poor lighting conditions or bad weather conditions such as rain or strong winds;
- Always ensure that parking brakes are engaged and all stabilisers or wheel chocks are properly positioned if the lorry is unattended;



Figure 8: Lifting of tent structure using lorry crane.

- Ensure that all lifting gear are certified and in good working condition before any lifting operation; and
- Ensure that any failure or malfunction of the lorry crane is reported to the lifting supervisor and documented.

6.5 Use of Mobile Elevated Working Platforms

Mobile Elevated Working Platforms (MEWPs) are used as temporary working platforms to gain access to work at a height. They are mobile machines with a work platform that position persons, tools and material at heights. In the tent sector, MEWPs may be deployed for installing electrical components such as fans and lighting. Examples of MEWPs include scissor lifts, boom lifts and vertical personnel platforms (see Figure 9).

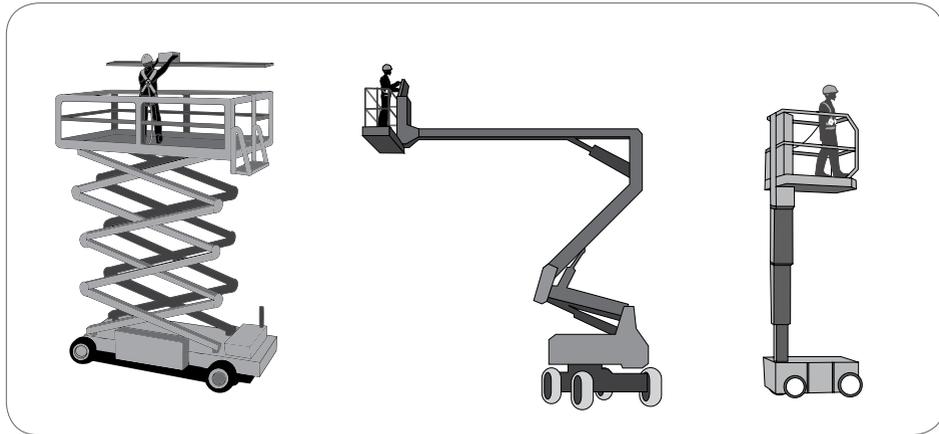


Figure 9: Examples of MEWPs (from left to right): scissor lift, boom lift and vertical personnel platform.

Before using a MEWP, check that:

- A thorough planning and site assessment has been done;
- A suitable and adequate MEWP has been selected for the task to be undertaken;
- The MEWP operator is competent and has completed the relevant MEWP operator courses;
- Appropriate PPE are provided in accordance with manufacturer's recommendation; and
- The MEWP has been inspected and certified by an authorised examiner.

For more information on use of MEWPs, see *Code of Practice for Working Safely at Heights*.

6.6 Use of Scaffolds

Scaffolds are commonly used to support people and hold materials while works are being performed. In the tent sector, scaffolds can be employed to access areas that are difficult to reach safely. However, there are certain hazards associated with scaffold usage, and care should be taken while using scaffolds.

Before using scaffolds, ensure that:

- All scaffolds have been inspected by a competent and authorised scaffold supervisor (except for trestle scaffolds or scaffolds which do not permit a person to fall more than 2 meters);
- All scaffolds have been inspected by a competent and authorised scaffold supervisor:
 - before its first use,
 - after substantial alteration,
 - after any event likely to have affected its stability; or
 - when it has been in place for 7 days.
- For tower scaffold (see Figure 10 for an example of a tower scaffold), it should be erected by a scaffold erector and inspected by a scaffold supervisor (as stated above).
- All scaffolds are used on stable ground;
- Proper access and egress are provided for;
- Basic PPE such as safety harness, helmet and safety shoes are worn;
- Scaffolds are not overloaded; and
- All scaffolds and their components must meet the requirements of the regulations stipulated in the Workplace Safety and Health (Scaffolds) Regulations.



Figure 10: A mobile tower scaffold with access ladder, opening and other features to provide a hazard-free working platform.

For more information on use of scaffolds, see *Code of Practice for Working Safely at Heights*.

6.7 Use of Hand Tools

Workers from the tent sector often use hand tools such as hammers, wrenches, ratchets, pliers and screwdrivers. Hand tools are usually employed during the assembly of tent structures before erection. These hand tools may appear harmless and are often underrated as sources of potential danger. If used in an improper manner, these hand tools can cause injuries such as cuts, abrasions, amputations and punctures.

Some recommended good practices when using hand tools:

- Use the right tool for the job (e.g., not using a wrench as a hammer);
- Do not use broken or damaged tools (e.g., screwdrivers with worn tips);
- Have firm grip and footing when using hand tools;
- Carry tools securely in a tool belt or box and do not carry sharp or pointed tools such as a screwdriver in clothes' pocket;
- Always pass a tool to another co-worker, do not throw or toss the tools;
- Use the right PPE for the job;
- Workers are provided with ergonomically designed tools for tasks that require repetitive or forceful actions;
- Workers are provided with tools in good working condition. Using a dull blade or blunt point can lead to injury; and
- Store tools properly after completing the task.

6.8 Weather Conditions

Singapore has two main monsoon seasons (December to March and June to September). Between these two monsoon seasons are relatively short inter-monsoon periods (April to May and October to November). During the monsoon seasons, heavy rainfall, strong winds and thunder are expected. Therefore it is recommended to put in place preventive measures to mitigate the risks, such as struck by lightning (see Section 6.8.1), posed by such adverse weather conditions.

Some recommended preventive measures to mitigate risks posed by adverse weather conditions are:

- Check the weather forecast at the National Environment Agency (NEA) website before starting outdoor works;
- When adverse weather approaches, stop all outdoor works and stay under a safe shelter; and
- Appoint a person to be in charge of monitoring weather conditions.

6.8.1 Lightning

Tent workers are often required to work outdoors. Coupled with Singapore's high rate of lightning activity throughout the year, tent workers working outdoors face a high risk of being struck by lightning.

When there is risk of being struck by lightning while working outdoors, stop all works in a safe manner and ensure that workers take safe shelter (e.g., a permanent building or enclosed vehicle).

If a safe shelter is not available:

- Take shelter in a low area as far as possible;
- Ensure that workers do not gather in a group but are spread out several metres apart from one another;
- Ensure that workers do not stand or take shelter under a tree; and
- Ensure that workers do not hold metal objects such as umbrellas.

6.9 Heat Stress

Workers working in the tent sector are required to work outdoors. Working in Singapore's hot weather can put your workers at an increased risk of heat stress. Heat stress, if not controlled, can lead to heat stroke and its consequences can be dire.

The following are some good practices that can be adopted to prevent heat stress:

- Ensure that workers are adequately acclimatised (see Section 6.9.1) before starting work;
- Provide sufficient drinking facilities (e.g., provide bottled water);
- Ensure adequate water intake;
- Ensure adequate rest breaks under shaded area; and
- Encourage workers to wear loose fitting and light-coloured clothing when working outdoors.

For more information on heat stress, see *WSH Guidelines on Managing Heat Stress in the Workplace*.

6.9.1 Acclimatisation

The tent sector comprises of workers from diverse nationalities. Workers from cooler climates would require their bodies to "get used" to the high temperatures in Singapore. This process, in which the human body learns to function in hot environments, is called heat acclimatisation.

Workers who are ill, on medication, or who have just recovered from illnesses are at higher risks of developing heat stroke. For this group of workers, depending on the circumstances, a short period of re-acclimatisation may be beneficial.

6.10 Fatigue

Fatigue is a state of tiredness leading to reduced mental and/or physical performance that compromises workplace safety. The onset of fatigue at work can decrease a person's alertness, slow down reflexes, and impinge judgement. All these have negative implications for WSH.

The best approach to counter fatigue is to have adequate sleep or rest. However, there are methods that can slow the onset of fatigue and provide temporary relief. Some recommended control measures are listed below.

Improving work environment:

- Provide adequate lighting;
- Provide adequate ventilation;
- Ensure that the environment is at an appropriate temperature; and
- Provide facilities for breaks such as a pantry or rest area (see Figure 11).



Figure 11: Workers taking a break at a rest area.

Work rescheduling:

- Schedule complex tasks to be performed during the day;
- Keep night shift work to a minimum;
- Limit shift work to not more than 12 hours including overtime;
- Plan shift schedules ahead of time and communicate them to employees; and
- Introduce a buddy system where appropriate.

For more information on fatigue management, see *WSH Guidelines on Fatigue Management*.

6.11 Handling Mobile Generators

Mobile generators supply temporary electrical power and are usually deployed when there is no alternative power source. Tents erected for events are usually accompanied by such generators. Below are safety tips with regards to handling mobile generators.



Figure 12: Barricaded mobile generators.

Safety tips for handling mobile generators:

- Ensure that the generator is sufficiently barricaded with appropriate signages to prevent unauthorised entry (see Figure 12);
- Ensure that electricity is not directly tapped from a mobile generator, use a Socket-Outlet Assembly (SOA) instead;
- Ensure that the earthing cable or earth electrode is not removed. The earthing system for a mobile generator is installed for electrical safety; and
- Ensure that the generator and associated earthing system is tested and certified fit for use by a Licensed Electrical Worker (LEW).

6.12 Handling Other Electrical Components

Tent workers are required to install electrical components such as fans and lightings in the tents before an event. If such electrical components are not handled appropriately, workers or passers-by may be electrocuted. Therefore it is important that these electrical components are handled and used in a safe manner.

Safety tips for handling other electrical components:

- Provide appropriate insulation protection for workers;
- Provide appropriate earthing to metal parts that come into contact with electricity;
- Ensure that all electrical installations are not damaged and in good working condition before use;
- Ensure that only industrial plugs (see Figure 13) are used for outdoor work, do not use a household plug;
- Ensure that hand tools or electrical equipment are not connected directly to the generator;
- Ensure that electricity is tapped safely from a Socket-Outlet Assembly (SOA) or Distribution Board (DB); and
- Remind workers that electrical components must not be handled with wet hands.



Figure 13: Industrial plugs.

7. References

WSH Council Guidance Materials

- Code of Practice on Workplace Safety and Health (WSH) Risk Management
- Code of Practice for Working Safely at Heights
- Code of Practice on Safe Lifting Operations in the Workplace
- WSH Guidelines for Safeguarding Against Falling Objects
- WSH Guidelines on Safe Operation of Forklift Trucks
- WSH Guidelines on Improving Ergonomics in the Workplace
- WSH Guidelines on Safe Loading on Vehicles
- WSH Guidelines on Fatigue Management
- WSH Guidelines on Managing Heat Stress in the Workplace
- WSH Alert: Worker pinned under collapsed racks

Regulations

- Workplace Safety and Health Act and its subsidiary legislations
- Building Control (Temporary Buildings) Regulations
- Fire Safety Act

Approved Codes of Practice

- SS 531: Code of Practice for Lighting of work places, Part 1: Indoor
- SS 531: Code of Practice for Lighting of work places, Part 2: Outdoor
- SS 531: Code of Practice for Lighting of work places, Part 3: Lighting requirements for safety and security of outdoor work places
- SS 567: 2011 Code of Practice for Factory layout – Safety, health and welfare considerations

8. Annex

Annex A: Comparison of Engineered and Traditional Tents

Traditional and engineered tents were briefly introduced in Section 1.1. They may look similar but these two classes of tents differ greatly and these differences have a great impact on WSH. Some of the key differences are summarised below.

S/No.	WSH Concern	Traditional Tents	Engineered Tents
1	Work at heights	 <p>Workers are required to work on top of tent structure to carry out tasks such as installation of purlins and tying of canvas sheet.</p>	 <p>Engineered tents do not require workers to work on top of the tent structure. Compared to traditional tents, there is a reduction in working at heights activities by as much as 70%.</p>
2	Installation of tent canopy	 <p>Manual laying and tying of canvas sheet on top of tent structure is required after tent structure is erected. This may require working at heights.</p>	 <p>Most engineered tent structures come with a slot-in railing feature for securing the tent membrane. Workers are not required to work on top of tent structure as no further tying is required once the tent membrane is in position.</p>

3	Structural integrity	Do not conform to any form of standards.	Designed and manufactured according to international standards such as BS 13782:2005 and DIN 4112.
4	Assembly of tent frame members	Tent components are typically self-fabricated and often require the use of hand tools during assembly.	Tent components are commercially manufactured using professional techniques and are designed in such a way that they can be assembled with minimal use of hand tools.
5	Installation and operation procedures	Procedures are seldom documented and typically passed on through verbal means and on-the-job-training.	There are well-documented procedures regarding installation of the tents. Training on installation procedure can be provided by tent manufacturers.
6	Ground stability	 Traditional tents are sitting on the ground without any form of anchorage.	 Engineered tents are designed for anchoring to the ground.
7	Ability to withstand weather conditions	Traditional tent structures are not designed with weather conditions taken into consideration.	Adverse weather conditions such as rain and wind loads are taken into consideration in the tent design.

Comparison of traditional and engineered tents

There are several types of engineered tents available in the market, with slight differences in method of assembly and dismantling. One type of engineered tent uses lorry cranes to lift the tent structure into position while another uses jacking devices to prop the tent structure into position. Despite these differences, the process of setting up and dismantling engineered tents eliminates the need for work on top of a tent structure. To eliminate or reduce the need for working at heights, the use of engineered tents is recommended.

Annex B: Tentage Safety Checklist

This checklist is produced by the WSH Council and Ministry of Manpower as a reference to help tentage stakeholders carry out tents-related work safely.

Checklist for Safe Tentage Works	
Company / Location:	Checklist Completion Date:
Person-in-charge:	

Work Activity	Possible Hazards	Recommended Good Practice	Please Tick			Follow-up Actions
			Yes	No*	NA**	
All tentage activities	All hazards related to tentage work.	 Workers are briefed on safe work procedures and job hazards during daily toolbox meetings.				
All tentage activities	Body injuries.	 Ensure that workers are equipped with the appropriate personal protective equipment.				
Outdoor tentage works	Workers may be exposed to bad weather conditions such as lightning and rain.	 Tentage works are carried out only during clear weather conditions.				

Reworking of tents to address defects	All hazards related to tentage work.	 <p>Before setting up, ensure that parts of the tents are in good condition.</p>			
Carrying out lifting operations	Struck by falling and/or moving objects.	 <p>When a lifting machine is used, ensure that:</p> <ol style="list-style-type: none"> it is operated by a qualified and competent person; the lifting gear is in a good working condition; the load is rigged properly before lifting; and the load is within permissible limits according to the load chart. 			
Using of ladders	Toppling of ladders and/or falls from ladders.	 <p>When ladders are used, ensure that:</p> <ol style="list-style-type: none"> they are in good working condition; they are used on stable and level ground; and workers maintain three points of contact on the ladders. 			

Working at heights	Fall from heights.	 <p>Ensure that fall prevention measures are put in place before starting work.</p>			
Handling electrical installations	Electrocution.	 <p>Ensure that electrical installations are dry and not damaged.</p>			
Working under direct sunlight	Workers may be subjected to fatigue and heat stress.	 <p>Ensure that sufficient water and rest breaks are provided.</p>			
Carrying out tentage works at night	Workers' visibility is reduced at night.	 <p>Ensure that sufficient lighting is provided.</p>			

This checklist may not cover all aspects of work activities in your workplace. You should review the checklist when there are changes to work activities.

** If "No" is indicated, fill in the "Follow-up Action" column.*

*** NA - Not Applicable.*

For more information on tentage safety, go to www.wshc.sg

Annex C: Five Golden Safety Rules

Pictograms		Description
	<p>Always maintain three points of contact when using a ladder.</p>	
	<p>Wear safety harness when working at heights.</p>	
	<p>Drink more water.</p>	
	<p>Wear personal protective protection (PPE).</p>	
	<p>Report unsafe condition to your supervisor.</p>	

For more information on the above pictograms, see *Guide to Good WSH Practices Pictograms*.

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