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Chapter 2

Section 15 : Personal Protective Equipment (PPE)

Contents

6. Personal Protective Equipment

6.1 Purpose

This section describes **SUPREME ENERGY** (the Company) Safety Standards to control the use, maintenance and selection of personal protective equipment (PPE).

Where a hazard cannot be controlled through other measures, the use of personal protective equipment or clothing is appropriate as the last resources to prevent injury or occupational illness. The use of personal protective equipment must be considered carefully to ensure that it is of the correct type and is properly used and maintained.

This requirements stated in this section shall apply to all activities for which personal protective equipment is required by appropriate safe work practices.

6.2 Definitions

Respiratory Protection
Protective equipment designed to enable persons to breathe when toxic gases, vapors or dusts are present, or there is insufficient oxygen.

Oxygen deficiency
Insufficient oxygen in air.

Dusts
Particles formed when solids are broken down, such as by sanding or grinding or excavation.

Fumes
Fine particles in air formed when metal is melted, vaporized, then quickly cooled.

Mists
Tiny liquid droplets suspended in air.

Gases
Gas-phase contaminants that can be toxic.

Vapors
Substances that evaporate from a liquid or solid.

Particulate
Includes dusts, mists and fumes.

Irritants
Substances that can cause discomfort or minor irritation but no tissue damage

6.3 Applications

Every personnel when working at the facility shall wear suitable protective clothing and use protective equipment appropriate to the work being undertaken. **Protective clothing/equipment shall be worn and/or used as required without exception. This applies to SUPREME ENERGY personnel, visitors, contractors and sub-contractors alike.**

The minimum required PPE consists of a hard hat, safety glasses, safety shoes and appropriate clothings (long-sleeve shirt and pants). Additional PPE may be required, depending on worksite conditions as may be specified in the Health, Safety and Environment (HSE) Procedures, or in location-specific signs and notices.

Construction areas, indoors and outdoors, are designated PPE areas with minimum PPE requirements.

Care should be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards should be taken.

Exceptions to the minimum PPE procedure are as follows: personnel working within offices, administrative areas, living quarters, villas, or heliports (PPE may be required, depending on work being performed and worksite conditions).

6.4 General Requirement

- Compliance to PPE requirements is the responsibility of both the individual employee and the Department or Group related to the job.

- Supervisors are required to assess the workplace to determine if hazards that required the use of PPE are present or likely to be present.

- Supervisors must certify in writing that a workplace hazard assessment has been performed (Job Safety Analysis / JSA, Work Procedure) to determine the requirement of PPE.

- Use PPE properly as per manufacturer instructions.

6.5 Responsibilities

- SUPREME ENERGY shall ensure that all protective equipment required for the safe execution of tasks is available to all personnel, and that a record of distribution of non-consumable personal protective equipment is kept.
- All physical activities and services within SUPREME ENERGY facilities conducted by contractors is mandatory to fulfill this procedure. This requirement shall be covered in each contract under HSE exhibits.
- Line Managers and Supervisors shall ensure that personnel are trained in the use and maintenance of personal protective equipment.
- Supervisors shall ensure that personnel are supplied with appropriate personal protective equipment, and that the equipment is maintained.
- Supervisors shall ensure that all members of the work party and all contractors and sub-contractors are wearing appropriate protective clothing and/or equipment.
- Management shall ensure that all personnel are directed and instructed in the use, care, fitting and maintenance of personal protective equipment.
- Management shall keep a record of details of training and persons approved for use of respiratory protection.
- All personnel shall be responsible for the care of personal protective equipment issued to them, including the correct use, cleaning and maintenance of the equipment.
- If personal protective equipment is not available, or is inadequate for a task, or if insufficient training has been provided, the personnel shall inform Management so that suitable equipment can be provided.

6.6 Inspection and Maintenance

- As a reminder for personal safety equipment to function correctly and not to fail putting the wearer at risk they shall be kept clean and well maintained. Defective items shall be replaced and never used.

- All PPE users shall inspect each PPE prior to utilizing. Defective PPE shall be replaced immediately and reported to their Supervisors.

6.7 Training

Prior to using PPE, employees shall be trained to gain knowledge of:

- When PPE is necessary?
- What type is necessary?
- How it is to be worn ?
- Its limitations and useful life.
- How to care, maintain, and dispose the PPE

Supervisors shall certify in writing that training has been carried out and that employees understand it. Each written certification shall contain the name of each employee trained, the date(s) of training, and identify the subject certified. Signed attendance list by Supervisor is considered as training certificate.

6.8 Hearing Protection

6.8.1 General

This section should be read in conjunction with Chapter 2: Section …: *Noise and Vibration*. As stated in Chapter 2: Section …: *Noise and Vibration* alternative measures to reduce noise levels effectively should be carefully considered before hearing protection is implemented.

Hearing protection shall be worn under the following circumstances:

- in an area sign posted “hearing protection required”.

Figure 1 : Sign Indicating Hearing Protection Shall be Worn in this Area

- for tasks where hearing protection is required as defined in appropriate Safe Work Practices.
- where noise levels have been measured to be above 85dB(A) over a period of 8 hours.
- where noise levels have been measured to be over 115dB(A) over any length of time.
- a good rule of thumb is if where one needs to raise one's voice to communicate with someone within 2 meters.

Training for the use of hearing protection will be done as part of the general induction training. (Refer to Chapter …: Section 5: *Training*). Hearing protection refresher training will be conducted periodically. Personnel will also be fitted and issued with hearing protection at this training as appropriate.

Audiometric testing shall be performed before employment and shall be repeated periodically as part of routine medical checkup for employee.

6.8.2 Selection

There are two main types of hearing protection that can be used:

- ear plugs,
- ear muffs.

There are several types of ear plugs, but the basic principle is the same for all types: they are a form of bung that is pushed into the ear canal.

A list of the advantages and disadvantages of air plugs and air muffs is given below in Table 1.

Table 1 : Advantages and Disadvantages of Ear Plugs and Ear Muffs

Advantages	Disadvantages
Ear Plugs	
• Easier to wear for most people - they are not hot or bulky and can be worn with other equipment • Disposable types are available	• Must be carefully fitted and periodically checked • Clean hands must be used to insert or remove plugs • Do not provide protection over 97dBA
Ear Muffs	
• One size will fit most people • Can be attached to hard hats • Greater protection can be provided (Note some activities will require the use of high efficiency ear muffs) • They are easy to remove and replace - an advantage for people who frequently move from a noisy place to a quiet place	• May make ears hot • Are bulky • Efficiency may be reduced if worn with spectacles, respirators etc.

Following an initial review of noise exposures (see Section …: *Noise and Vibration*), various areas will be designated hearing protection zones.

In most situations there will be a selection of protective devices that have the required hearing protection grade (i.e., a choice of ear muffs or plugs). In these cases, the individual workers will select the type of hearing protection that is most practicable for them. This is because the most important factor in achieving a high degree of hearing protection is that the hearing protection be worn at **all** times when the personnel is exposed to excessive noise.

Hearing protection shall be used when personnel are exposed to excessive noise levels and exposure time, as stated in OSHA Permissible Noise Exposure as listed in Table 2 below.

Table 2 : Noise / Sound Level, Exposure Time and Hearing Protection Grade

Duration per day (hours)	Noise Level dBA (slow response)	Hearing Protection Grade
8	85	1
6	92	2
4	95	
3	97	3
2	100	
1 ½	102	
1	105	4
½	110	5
¼ or less	115	

There are standards for hearing protection grades. Hearing protective devices will be labeled as to meeting one of the grades. When using Hearing Protection Devices, one shall refer to its Noise Reduction Rate (NRR).

Grade 5 ear muffs provide the highest level of hearing protection. In some instances, ear plugs and Grade 5 ear muffs will be required to be worn together in order to provide sufficient protection. For example work in the vicinity of the venting of steam via a rock muffler.

6.8.3 Use

The removal of hearing protectors for even very brief periods of time can dramatically reduce their effectiveness and lead to under-protection for the wearer. Where hearing protection is required, it must be used at all times. Failure to wear hearing protection when required could result in damage to hearing.

Management shall ensure that “quiet” locations or periods are available for personnel to have breaks from noisy activities and wearing hearing protection.

When using hearing protection, it is much more difficult to hear instructions or warning noises. This should be taken into account for work practices, and alternative arrangements shall be made for communication and warnings.

6.8.4 Maintenance

Personnel should regularly inspect their hearing protectors to detect damage or deterioration. Disposable earplugs shall not be reused due to the risk of ear infection. Reusable ear plugs shall only be used by one person.

Ear muffs shall be replaced if their acoustic packing becomes loose, or where the padding is worn, damaged or missing. Checks should be carried out before use to ensure padding and packing condition is adequate.

Adequate provision should be made for clean storage of protectors when not in use. Facilities should be readily available for the cleaning of reusable protectors. Hearing protection devices should be cleaned and disinfected according to the manufacturer's instruction.

6.9 Eye and Face Protection

6.9.1 General

Eye and face protection shall be worn when a job assignment or work area indicates the need for such protection.

Eye and face protection should be worn where there is a possibility of injury from:

- flying particles,
- chemical vapors or gases,
- chemical liquids, acids or caustic,
- molten metal.

Personnel working on a task which has the potential to cause eye injury shall wear appropriate eye protection such as full-face shields or safety glasses. Examples are working with grinders, breaking glass, lathes, drills, etc. as specified in appropriate Safe Work Practices. Other areas in which eye protection is required (e.g. the laboratory) will be sign-posted.

Training for the use of eye protection will be done as part of the general induction training.

6.9.2 Selection

Protective eyewear and face includes, but is not limited to:

- prescription and non-prescription safety glasses,
- welder's goggles and shields,
- chemical splash goggles,
- impact-type goggles,
- face shields,
- full-face respirators.

The type of eye protection available, together with their description and uses is briefly described in Table 3 below.

Table 3 : Eye and Face Protection Selection

Source	Assessment of Hazard	Protection
IMPACT-Chipping, grinding machining, masonry work, woodworking, sawing, drilling, chiseling, powered fastening, riveting, and sanding	Flying fragments, objects, large chips, particles sand, dirt, etc	Spectacles with side protection, goggles, face shields. See notes (1), (3), (5), (6). For severe exposure, use face shield
HEAT-Furnace operations, pouring, casting, hot dripping, and wielding	Hot sparks	Face shields, goggles, and spectacles with side protection. For severe exposures, use face shield. See notes (1), (2), (3)
	Splash from molten metals	Face shields worn over goggles. See notes (1), (2), (3)
	High temperature exposure	Screen face shields, reflective face shields. See notes (1), (2), (3)
CHEMICALS-Acid and chemicals handling, decreasing plating	Splash	Goggles, eyecup and cover types. For severe exposure, use face shields. See note (3)
	Irritating mists	Special-purpose goggles
DUST-Woodworking, buffing, general dusty conditions	Nuisance dust	Goggles, eyecup and cover types. See note (8)

Continue Table 3 : Eye and Face Protection Selection

Source	Assessment of Hazard	Protection
LIGHT and/or RADIATION		
- Welding: Electric arc	Optical radiation	Welding helmets or welding shields. Typical. Shades: 10-14. See note (9) and see Filter Lenses for Protection Against Radiant Energy Table
- Welding: Gas	Optical radiation	Welding goggles or welding face shields. Typical shades: gas welding 4-8, cutting 3-6, brazing 3-4, See note (9)
- Cutting, Torch brazing, Torch soldering	Optical radiation	Spectacles or welding face shields. Typical shades, 1.5-3. See notes (3), (9)
- Glare	Poor vision	Spectacles with shaded or special purpose lenses, as suitable. See note (9)

Caution notes:

1. Care should be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards should be provided. Protective devices do not provide unlimited protection.
2. Operations involving heat may also involve light radiation. As required by the standard, protection from both hazards must be provided.
3. Face shields should only be worn over primary eye protection (spectacles or goggles).
4. As required by the standard, filter lenses must meet the requirements for shade designations. Tinted and shaded lenses are not filter lenses unless they are marked or identified as such.
5. As required by the standard, persons whose vision requires the use of prescription (Rx) lenses must wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear.

6. Wearers of contact lenses must also wear appropriate eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments might represent an additional hazard to contact lens wearers.
7. Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.
8. Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleansing may be necessary.
9. Welding helmets or face shields should be used only over primary eye protection (spectacles or goggles).

Note :

For grinding operations (both handheld and bench type) the operator must wear full face shield over approved safety glasses or goggles.

Table 4 : Filter Lenses for Protection Against Radiant Energy (*)

Operation	Electrode Size 1/32 Inch Diameter Standard (torch)	Arc Current (AMPS)	Minimum Protective Shade
Shielded metal arc welding	< 3/32 3/32-5/32 5/32-8/32 > 8/32	< 60 60-160 160-250 250-500	7 8 10 11
Gas metal arc welding and flux cored arc welding		< 60 60-160 160-250 250-500	7 10 10 10
Gas Tungsten arc welding		< 50 50-150 150-500	8 8 10
Air carbon arc cutting	(Light) (Heavy)	< 500 500-1000	10 10
Plasma arc welding		< 20 20-100 100-400 400-800	6 8 10 11
Torch brazing Torch soldering Carbon arc welding		- - -	3 2 14

(*) Reference ANSI Z87.1-1989

6.9.3 Use

Where eye and/or face protection required, it shall be used at all times. Failure to wear eye and/or face protection when required could result in permanent eye damage or blindness.

Glasses or visors should fit well, so that they do not move or slip whilst being worn.

Impact-type eye protection (goggles) shall be worn when chipping, scraping, grinding, hammering or any activity involving flying or falling objects or particles. Splash-proof chemical goggles shall be worn when handling hazardous chemical liquids or in any other operation where the eyes may be exposed to hazardous chemicals in either liquid or solid form.

Goggles are also required when:

- dust hazards exist,
- working on lines, vessels, etc., where vapor, gas, air, fluid, or solid may be trapped under pressure,
- cutting and tying of cable or wire rope, or
- operations where there is danger from the spraying of oils or chemicals.

6.9.4 Maintenance

Personnel should inspect eye and face protection regularly to detect damage or deterioration.

Lenses shall be kept clean, otherwise visibility will be obscured. Warm water and washing liquid applied with a soft cloth is effective for lens cleaning. Facilities should be readily available for the cleaning. Adequate provision should be made for clean storage of protectors when not in use.

6.10 Head Protection

6.10.1 General

Safety helmets (or hard hats) provide protection when working in areas where there is a potential for head impact or penetration from falling or flying objects.

In addition, protective headwear designed to reduce electrical shock hazard should be worn by employees when near exposed electrical conductors that could contact the head. Specified hard hat areas include exploration and production fields, construction sites and power plants.

Hard hats are the primary form of protection. Hoods and neck protection may also be necessary where there is a risk of hazardous substances entering via the collar.

Hard hats are divided into three classes:

- Class G - general service, limited voltage protection up to 2,200 volts. (Formerly class A).
- Class E - utility service, high-voltage protection up to 20,000 volts, use extensively by electrical workers. (Formerly class B).
- Class C - special service, no voltage protection.

Hard hats shall meet ANSI Z89.1 Class C or E specifications or SUPREME ENERGY approved equivalent.

6.10.2 Selection & Use

Where hard hats are required, hard hats with ratchet type suspension system must be worn at all times. Chin strap must be used when working at height.

Hard hats shall be worn under the following types of conditions:

- At construction sites.
- When working on or near hoists, A-frames, or overhead gantries.
- In any area where overhead work is occurring or conditions require head protection - in and around tanks and low overhead work areas.
- In areas where other departments or SUPREME ENERGY require hard hats.
- In any posted areas.
- Metal hard hats are not permitted within the SUPREME ENERGY area of operations.
- Validity of hard hats shall be in accordance with the manufacturer instruction.
- The outer shell of hard hats should not be drilled, cut, damaged, or otherwise modified in any way that will affect structural integrity, unless approved by the manufacturer.

- The painting of hard hats is prohibited as it may affect their impact resistance. Name tags shall be affixed with glue, do not engrave hard hats.

6.10.3 Maintenance

Suspension systems (plastic support placed within the hard hat) should not be removed from a hard hat.

Hard hats should be stored out of direct sunlight. Do not carry or store hard hats on the rear windows shelf of an automobile, since sunlight and extreme heat may adversely affect the degree of protection.

Plastic hard hats become more brittle and weaken over time, due to UV degradation.

All components i.e. shells, chin strap, suspensions, head bands, sweat bands, and any accessories shall be visually inspected daily for signs of dent, crack, penetration, or any other damage that may reduce the degree of safety originally provided. If damaged, the hard hat and/or its components shall be replaced.

Cleaning shells is dipping them in hot water (approximately 60 ^{o}C) containing detergent for at least one minute. Do not use any oil-based solvent (thinner) for cleaning.

Usually, in accordance with the manufacturer's recommendations, the hard hats are replaced every two years.

6.11 Protective Clothing

6.11.1 General

SUPREME ENERGY shall provide work clothes for each work site employee.

Protective coating give skin protection to arms, body and legs. It can be in forms of uniform (long-sleeves with long pants) or coveralls.

Coveralls provide general skin protection, and are available in a variety of different materials and styles. They may be disposable, breathable, waterproof, fire resistant, or chemical resistant, and may have a hood to protect the head and prevent substances entering via the collar.

Further skin protection is available via the use of gloves and gauntlets where there is a risk of skin contact with harmful materials, sharp objects, or hot/cold surfaces.

Protective clothing will also assist in keeping acidic, corrosive, oily, dirty, or dusty materials off of the body. The type of protection recommended depends upon the nature of the hazard.

6.11.2 Selection & Use

Site Supervisor shall determine the suitable type of protective clothings base on each working condition.

Synthetic coveralls shall not be worn in hazardous areas (where a flammable atmosphere may be present), due to the risk of ignition from static discharges. Cotton is recommended.

Clothing/Apron - Specific protective clothing shall be used as manufacturer guidance against specific hazard such as: hazardous chemical (minor or major splash), radiant heat, flame, harmful particulate, etc.

Aprons constructed of chemical resistant material (PVC, neoprene) should be worn when handling chemicals (pouring etc.) or washing out containers.

Synthetic clothing and underwear shall not be worn where there is a risk of burning or electrocution, as it will melt onto the skin and cause severe burns. Natural fibers are recommended.

Use of high-visibility vest or working clothes with reflecting light stripe is required when working at environment with low visibility. High-visibility vest is recommended to be used when working near heavy equipment.

6.11.3 Maintenance

Where coveralls and other protective clothing are provided, they shall be washed on a regular basis to avoid skin infection. Where hazardous substances are present on the clothing, the laundry should be informed of the risk.

6.12 Foot and Leg Protection

6.12.1 General

Foot protection shall be worn by employees when working in areas where there is a danger of foot injuries from falling and rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards. When responding to spills or release of hazardous substances, chemical-resistant footwear should be worn.

6.12.2 Selection & Use

Safety shoes shall be issued to individuals as appropriate by SUPREME ENERGY Management.

Safety shoes come in a wide variety of styles with numerous protective features. Protective features include steel toes, oil resistant soles, foot guards, and non-spark properties

Boots are preferable to shoes, as they also offer ankle protection. In some industrial situations, there may be caustic or acidic materials on the floor, and so it is necessary to select a sole compound which is resistant to these substances. Otherwise, selection should be based on comfort.

Safety shoes are to meet ANSI Z41.1 specifications or SUPREME ENERGY-approved equivalent. This standard specifies the minimum impact and compression forces the shoe toes may withstand.

Use metal-free non-conductive shoes or boots when work around exposed electrical wires or connections and use rubber safety boots to handle chemical.

Welder shall wear leather leggings during conducting the job.

Personnel working with potential ankle injury risk shall use safety boot (e.g. rigger, gardener, grass cutter, roustabout, welder, carpenter, dustman, sand-blaster).

6.12.3 Maintenance

Safety footwear should be repaired or replaced once the sole is excessively worn, or if the sole is parting from the upper, or if the protective parts are significantly damaged.

Do not paint safety shoes.

6.13 Hand Protection

6.13.1 General

Gloves provide protection against specific chemical agents, temperatures extremes, traumatic injury cuts and act as barriers to protect the skin.

6.13.2 Selection & Use

Hand protection shall be issued to individuals as appropriate by SUPREME ENERGY Management.

Proper selection of gloves is important. The type of hand protection required depends on the tasks to be performed. Check with a Supervisor on glove suitability to obtain the correct glove for the task, base on the duration, frequency, and degree of exposure to hazards.

Glove shall be fit right to the hand size.

Do not wear gloves while working on moving machinery. (e.g. vertical drill machine, rotary saw machine).

Gloves shall be worn, when handling chemicals, or objects which could cut, splinter the hand.

Gardeners or outdoor workers, who are working in bush area, shall wear leather gloves in addition to minimum PPE in order to protect them from snakebite.

In general the following selections should be made:

- **Leather** - protects hand against splinters, scratches, etc. and should be worn in general manual handling situations, e.g. grass cutting, metal working, welding, grinding, general labor.

- **PVC** - protects against mild corrosives and irritants.
- **Latex -** provides light protection against irritants and limited protection against infectious agents.
- **Natural rubber** - protects against mild corrosive material and electric shock.
- **Neoprene** - for working with solvents, oils or mild corrosive materials.
- **Cloth / Cotton** - absorbs perspiration, keeps objects clean, provides some limited fire retardant properties.
- **Aluminized fabric or other special materials** - for protecting against intense heat.
- **Insulated** – special made up of rubber to protect against electrical shock and burns from high voltage current.

Rubber protective equipment for electrical activities must conform to the requirements established in ANSI as specified in the following list:

Table 5 : Rubber Protective Equipment for Electrical Activities

Item	Standard
Rubber insulating gloves	ASTM D 120-87
Rubber matting for use around electrical apparatus	ASTDM D 178-88 or 178-93
Rubber insulating blankets	ASTM D 1048-93 or 1048-88A
Rubber insulating hoods	ASTM D 1048-88 or 1049-93
Rubber insulating line hose	ASTM D 1050-90
Rubber insulating sleeves	ASTM D 1051-87

6.13.3 Maintenance

When working with extremely corrosive materials, wear thick gloves. Take the extra precaution in checking for holes, punctures and tears.

Gloves shall be discarded after handling chemical and biological hazards.

Hand washing is required after removal of gloves to ensure no contamination to skin.

Reusable gloves should be cleaned or decontaminated and stored in a clean area.

Oil contaminated gloves should be disposed properly of when use has finished.

6.14 Barrier Creams

Barrier creams should be applied to hands, in situations where oil, grease etc. will contaminate hands over the working day. The barrier creams prevent this material entering skin pores and makes cleaning of hands at the end of the day easier.

Barrier creams will be provided on an as required basis, for the workshop and maintenance staff at the site.

It should be noted barrier creams provide additional protection against skin irritants and substances which remove natural oils from the skin. Sun screen is a specific form of barrier cream, which reduces the risk of burning and melanoma by filtering the UV component of sunlight.

People with sensitive skins or skin allergies may suffer irritation from certain barrier creams.

Barriers provide very limited skin protection when handling solvents/degreasers, etc. Gloves shall be worn when handling these substances.

6.15 Fall Protection Equipment

Fall protection equipment shall be worn when persons are working at heights where falling may cause an injury or fatality.

The standard fall protection equipment is full body harness. Refer to Chapter 2: Section ….: *Working at Heights* for more details on the types of fall protection equipment; to use and checks to perform before use; and the maintenance of body harnesses and lifelines.

6.15.1 Selection & Use

Supervisors shall ensure that fall protection equipment shall be worn by personnel whenever there is the possibility of a fall. The following are some examples where the system shall be used:

- When working on elevated positions where a fall hazard exists and there is no physical protection such as handrails.
- When working from ladders while both hands are needed for the work being performed.
- When working from the basket of an articulating boom.
- When workings on open steel, piping, equipment, or while erecting scaffolding or structural steel.
- While working on an elevated surface (e.g. roofs) with a slope greater than 15 degrees where catch platforms are not provided.
- When working at an elevation of 1.8 meters or more where there are no physical protection such as handrails and are at risk of a fall or need both hands free perform their work.

Personnel working at height more than 1.8 meters shall wear full body harness with 2 (two) lanyards for worker's 100% tied off during reposition, life lines, and drop lines (ANSI A10.14 specifications establish performance criteria for the construction and use of this equipment).

Where a lanyard and harness have been subjected to a free fall and therefore been shock loaded, the items shall be used anymore and destroyed.

6.15.2 Maintenance

All body harnesses and landyards shall be returned after use to the Safety Equipment Store. They will be stored in clean polypropylene or canvas bags. Lines will be coiled to ensure they do not become tangled. The harness will be checked to ensure it has not been contaminated with oil, etc., which could result in the webbing material losing its strength.

All webbing will be checked on a regular basis for wear and tear, stitching failing, fraying, etc. A harness in a poor condition should be replaced.

6.16 Respiratory Protection

6.16.1 General

The type of respiratory protection required will be defined in the appropriate Safe Work Practice. The level of protection will be selected based on the type and level of contamination, and the type of work being done.

6.16.2 Selection

Respiratory protection mask shall have double inhalation valves.

The selection of respiratory protection shall be done by specifically trained HSE personnel. Occupational monitoring will normally be required as part of this selection. Any respiratory devices used by Company staff shall have NIOSH/OSHA/ANSI Z88.2 or similar international standard approval.

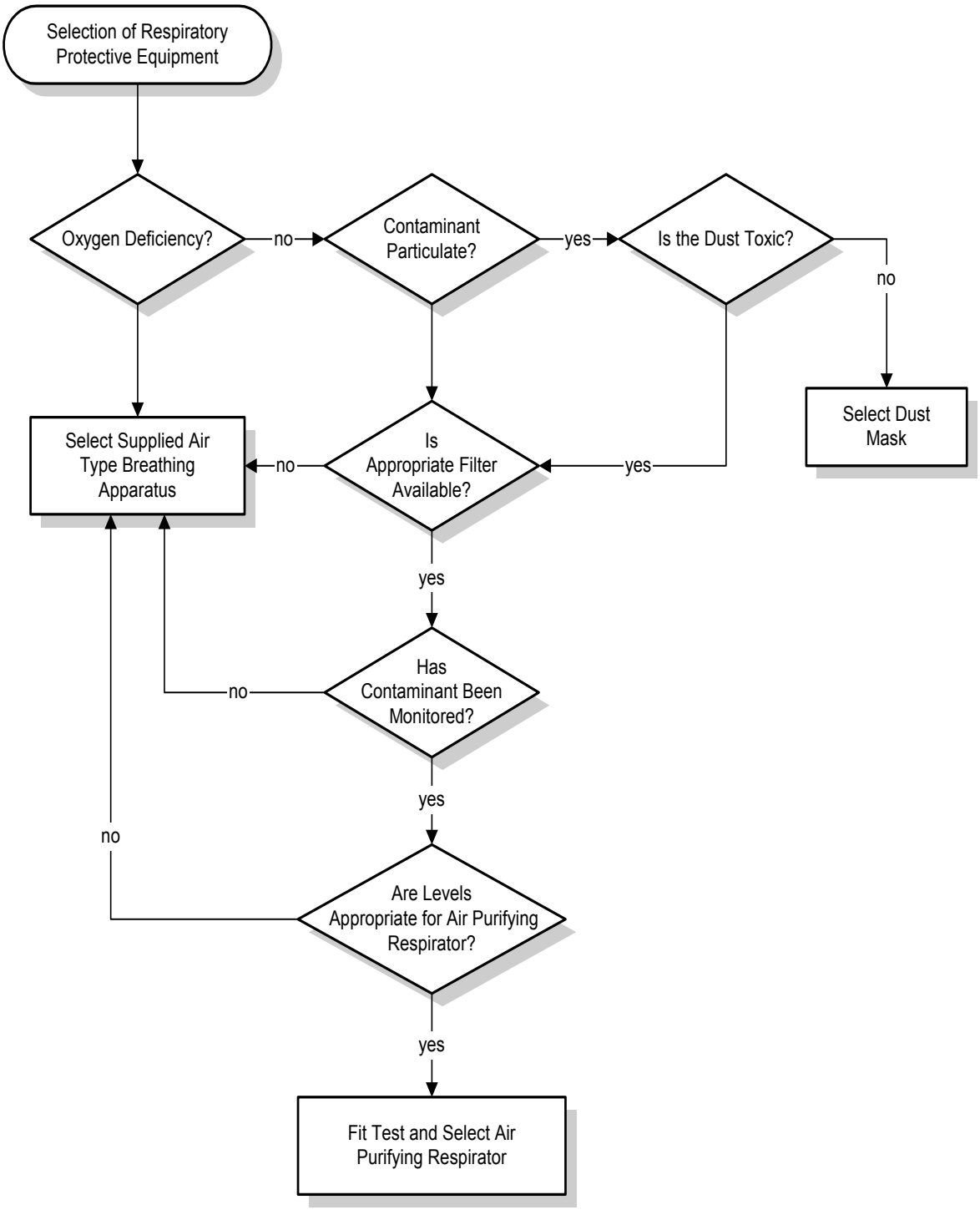
Summaries shall be provided of locations or jobs where airborne contaminant readings are above the exposure limits and shall specify:

- Types of respirators to be used.
- Types of filters, canisters, and cartridges used specifying change frequencies and the basis for change frequencies.
- Evaluation with supervisors and HSE personnel regarding whether hazards can be cost effectively countered with engineering controls.

Air purifying canisters, cartridges and filters used with respirators shall be selected based on the hazard involved (dust, mist, vapors, fumes, gases) and manufacturer recommendation.

A rule for selecting the appropriate type of respiratory protective equipment to use is presented in Figure 2.

Figure 2: Selection of Respiratory Protection Equipment



There are two main types of respirators to be used by SUPREME ENERGY personnel:

i) air purifying double inhalation valves type, and
ii) supplied air.

An air purifying respirator filters the air breathed, either mechanically (in the case of particles) or chemically (e.g. solvents are filtered by absorption onto charcoal or other materials).

Air-purifying respirators can be used only for specific contaminants as specified on the manufacturer canister/cartridge selection criteria and must not be used when there is insufficient oxygen or extremely high levels of contaminants. A summary of type air purifying respirators and what they should be used for is given in Table 6.

Air purifying respirators shall not be used for rescue, emergency work, or in any atmosphere that could be Immediately Dangerous to Life and Health (IDLH).

Note: Potential IDLH means those situations involving operations that may result in a significant release of toxic materials, such as H_2S. This level represents a maximum concentration from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects.

Pressure-demand Self-Contained Breathing Apparatus (SCBA) or Supplied Air-line Breathing Apparatus (SABA) with emergency escape SCBA shall be used during the following conditions:

- work with potential oxygen deficiency.
- confined space entry prior to the atmosphere being certified safe to enter without SCBA/SABA.
- potential exposures to atmospheres IDLH.
- when performing any job where the ambient concentration of H_2S is above 10 ppm or could reasonably be expected to exceed 10 ppm during the course of the work.

Table 6: Respirator Types - Air Purifying

	Name	Type	Use	Limitations
	Dust Mask	Half face disposable dust mask (2 elastic straps)	Protection against nuisance dusts and mist.	Not to be used for toxic dusts or oxygen deficiency. Clean shaven important for good fit.
	Half-face Respirator	Reusable plastic or rubber mask, fitted with disposable cartridges and/or high efficiency filters.	Protection against specific gases, vapors and toxic dusts.	Mask needs to be fitted and maintained. Cartridges need to be replaced. Facial hair not permitted. Not to be used for oxygen deficiency.
	Full-face Respirator	Similar to half-face except that it covers the whole of the face (including eyes).	Similar to half-face. Better seal possible. Also gives eye protection.	Mask needs to fitted and maintained. Cartridges need to be replaced. Not to be used for oxygen deficiency. Should not be used with beards.
	Powered Air-Purifying Respirators (PAPR)	These includes a half or full-face respirator, cartridges and/or filters, a blower and a battery pack to supply air at positive pressure.	Seal is not as important (can be used with beards if contaminant concentrations not greater than 10 times “safe level”). Cooler and more comfortable to use.	Mask needs to fitted and maintained. Cartridges need to be replaced. Not to be used for oxygen deficiency.

Table 7: Respirator Types - Supplied Air

	Air Line, Continuous Flow (SABA)	Supplies air at a constant rate through a hose to respirator or cloak.	Seal not necessary (can be used with beards). Cooler and more comfortable to use. Requires clean air source and air pump.	Mobility restrictions. Not to be used if IDLH (immediately dangerous to life and health) conditions exist, unless escape apparatus also used.
	Self -contained Breathing Apparatus (SCBA)	Supplies air from tank worn by operator to sealed mask.	Can be used in oxygen-deficient atmospheres. Should not be used if facial hair present.	Mobility restrictions. Time limited.
	SCBA - Escape Pack (ELSA)	Supplies air from small tank to hood worn over workers head.	Can be used with facial hair. Can be used in oxygen-deficient atmosphere.	Must only be used for escape purposes. Duration of use: 5 to 8 minutes.

Breathing air may be supplied to respirators from cylinders or breathing air compressor:

a. Cylinders shall be tested and maintained as per manufacturing recommendation.

b. The compressor for supplying air shall be equipped with necessary safety and standby devices. A breathing air type compressor shall be used.

A supplied air respirator provides clean air to the worker. Details of supplied air respirators are given in Table 7.

6.16.3 Use

Respirators should only be used if the conditions listed below are met:

- The respirator is required in a Safe Work Practice.
- An appropriate and current certificate of competence is held by the wearer.
- The respirator type has been successfully fitted to the individual concerned;
- If a respirator has been fitted on a clean-shaven basis, the respirator is worn on a clean shaven face.
- The respirator will provide sufficient level of protection.
- Respirator is adequately maintained.

6.16.4 Medical Qualification

Each person using a respirator shall be medically qualified. Assessment shall be made during the physical examination.

No glasses with temple bars including prescription glasses, and contact lenses shall be worn under respirators. Physicians must determine if the worker's visual acuity is sufficient to permit safe emergency escape while using SCBA without glasses.

Respirators will only be issued to persons medically fit to wear them. Personnel who demonstrate any psychological limitations such as claustrophobia or anxiety while wearing a respirator or who are suffering from any physical limitation such as emphysema or asthma or heart disease or anemia or epileptic seizures as determined by medical examination, shall not participate in work that requires the use of respirators.

Note : respirators shall not be issued to any person who has not achieved the appropriate certificate of confidence.

6.16.5 Fit

All personnel wearing of respiratory protection shall be fit-tested with the appropriate type of respirator. Respirators shall not be issued to any person where a respirator cannot be found to give a good fit.

The fit test will include:

- negative pressure test
- positive pressure test

Personnel should not wear any respirator type for which they have not been specifically fit-tested. Repeat fit testing should be conducted whenever type/size of the respirator is changed.

Personnel shall qualitatively check the fit of their mask before each use. The positive pressure and/or negative pressure fit tests are to be carried out each time an individual puts on a respirator.

Negative Pressure Fit Test

- Place the palms of the hands over the openings in the filter retainer (if so equipped).
- Inhale and hold breath for about five seconds.
- If the face piece collapses slightly and no air leaks between the face piece and the face are detected, a good fit has been obtained.
- If air leaks are detected, reposition the face piece on the face and/or re-adjust the tension of the elastic straps and repeat the negative pressure check until a tight seal is obtained.

Positive Pressure Fit Test

- Hold thumb or palm of hand over outlet of exhalation valve guard.
- Create a slight positive pressure inside face piece by exhaling gently.

- If the face piece bulges slightly and no air leaks between the face piece and face are detected, a tight fit has been obtained.
- If the air leaks out between the face piece and the face, re-adjust the tension of the elastic straps to eliminate the leakage. This check shall be repeated until a tight seal of the face piece is obtained.

Facial features and/or the presence of facial hair may interfere with the fit of respirators, as can the use of spectacles.

Moustaches and stubble growth may spoil the fit of a respirator. Bearded persons cannot expect to achieve adequate respiratory protection when wearing a full-face respirator or a half-face air purifying respirator, accordingly, no one who requires respiratory protection shall attempt to wear either a full-face or half-face air purifying respirator over a beard.

Positive pressure respirators can be worn with a beard. However, with a beard the amount of breathing time an SCBA bottle can provide may be reduced. If necessary, a bearded person may use a continuous flow airline.

It is SUPREME ENERGY policy that personnel who in the course of their regular duties are required to wear a respirator then they shall be clean-shaven. Beards are allowed for those persons who on limited occasions are required to wear respiratory protection.

6.16.6 Training

Staff required to wear respiratory protection (other than dust masks) on an occasional, regular or emergency basis shall undergo a specific training and fit testing program. Training will be provided by external agencies or by appropriately trained and experienced SUPREME ENERGY personnel.

All staff required to wear respiratory protective equipment on a regular basis shall participate in a Respiratory Protection training program. Following this initial training, staff will be required to participate in an annual refresher course.

New staff must complete the Respiratory Protection training program before carrying out any work that requires the use of respirators. On completion of the course, staff will be issued with a certificate of competence which will be valid for the following year, and will be renewed after they have done their refresher course.

The training shall cover:

- conditions under which Respiratory Protection should be worn
- types of Respiratory Protection
- fit testing
- maintenance.

Management shall keep a record of details of training and persons approved for use of respiratory protection.

6.16.7 Storage, Cleaning and Maintenance

6.16.7.1 General

When used regularly, respirators will be issued to individuals (as practicable) for his or her exclusive use. A record of respirator issue and usage should be established and maintained.

Where respirators and supplied air sets are infrequently used, these will be pooled and available for use by any trained individual.

A clean store (Safety Equipment Store), at a convenient part of the site, shall be equipped for the cleaning and storage of respirators. One person shall be responsible for the storage and maintenance of pooled respirators in each area. All persons who issue respirators shall be trained specifically in the issue, selection, upkeep, maintenance and control of safety equipment.

Where a respirator is issued to an individual (air-purifying respirators only), that individual is responsible for its cleaning and use.

When used routinely, respirators shall be cleaned daily. The personnel will be trained in the cleaning of their respirator.

Pooled respirators must be cleaned and disinfected after each use. No device should be issued unless it was cleaned and disinfected after its last use. Prior to re-issue, respirators should be inspected in accordance with the manufacturer's instructions to ensure correct operation of the respirator.

The Safety Equipment Maintainer will ensure that:

- details of all respirator use are recorded.
- exhalation and inhalation valves are checked on return.
- respirators are inspected for defects.
- filters and cartridges are stored correctly.
- filters and cartridges are replaced as appropriate (see below).
- respiratory protective equipment is repaired and replaced of.

6.16.7.2 Filters and Cartridges

Filters should be stored in sealed containers bearing the date of last inspection. No filters should be stored for longer its expiration date.

When in use, filters should be changed regularly. The following is a guide:

Particulate filters	Change filter when breathing resistance noticeably increases (i.e., the filter pores are clogged).
Gas Respirators	Change filter when odor or taste is perceived by wearer; or when wearer coughs or experiences discomfort; or after a maximum of 4 hours of continuous use.

Note: the length of time for which a filter can be used is dependent on the concentration of the contaminant.

Used filters must be disposed of in an approved manner.

6.16.7.3 Self-Contained Breathing Apparatus (SCBA)

All SCBA should be maintained and stored in a condition that allows them to be used immediately. Cylinders of compressed oxygen or air shall be fully charged and stored at the recommended working pressure. Only fully charged cylinders shall be issued for use. Partially charged cylinders should be discharged and refilled.

6.16.7.4 Air Check

Cylinders should be checked on a regular basis to ensure the air is clean and free from contaminants. Checks should be made to ensure the air is not contaminated with hydrocarbons, carbon monoxide and/or carbon dioxide.

Simple on-site checks can be performed by releasing air from a cylinder into a gas tight bag. From the bag, a sample of air can be drawn through a gas detector tube in order to measure for the presence of possible contaminants (CO, NO, and/or CO_2). Additional checks include smell and venting air through a clean cloth.

On a regular basis cylinders should be sent to an approved laboratory for contaminant testing.

As well as testing the cylinders, if a breathing air compressor is used on site to fill air cylinders a weekly inspection should be performed to ensure discharge air is clean and safe to breath.

6.16.7.5 Straps and Harnesses

SCBA and respirator masks should be stored with all straps and harnesses adjusted to maximum size. On return to the store, the condition of all straps and the operation of all buckles shall be checked.

6.17 Emergency Breathing Apparatus

SCBA that is assigned to emergency use shall be kept solely for this use and is never to be used for normal work related duties.

6.17.1 Emergency SCBA Sets

Emergency SCBA sets are to be maintained full and ready for use. Straps are to be fully loosened and face mask straps are to be pulled back over the front of the mask ready for immediate use.

Emergency SCBA is to be inspected weekly to ensure bottles are fully charged.

6.17.2 Emergency Life Support Apparatus (ELSA)

ELSA sets are designed for emergency escape only and are never to be used for any other purpose.

ELSA sets are to be stored in all areas deemed to present a significant fire or gas hazard. They are to be clearly marked and put in easy-to-access locations within each area.

In dusty and outdoor areas they are to be stored in a purpose designed box that has a quick release catch. In other areas they are to be on purpose designed storage shelf.

In addition, ELSAs are to be available to workers, on an as required basis for work that may require emergency escape.

All ELSA sets are to be inspected weekly and on issue. They are always to be maintained fully charged and ready to use.

ATTACHMENT 1: RESPIRATOR FIT-TEST RECORD

(Catatan Uji Kesesuaian Alat Pernafasan)

Site : ……..

Employee Number	Name	Age	Position	Fit Test Date	Respiratory Size	Remarks

Certified by:

(Competent Tester)

ATTACHMENT 2
STANDARDS CROSS REFERENCE

Safety Glasses

ANSI Z87.1	-	Practice for Occupational and Educational Eye and Face Protection
BS 2092	-	Industrial Eye Protectors
DIN 4642	-	Lenses for Eye Protectors
DIN 58210	-	Protective Goggles
ISO 4849	-	Personal Eye Protector

Hard Hats

ANSI Z89.0	-	Protective Headwear for Industrial Workers
BS 5240	-	Industrial Safety Helmets
DIN 4840	-	Industrial Safety Helmets
ISO 3873	-	Industrial Safety Helmets

Safety Shoes

ANSI Z41	-	Safety - Toe Footwear
BS 1870	-	Safety Footwear
DIN 4843	-	Safety Footwear
ISO 2023	-	Lined Industrial Rubber Footwear

Welding

ANSI/ASC Z49.1	-	Safety in Welding and Cutting
BS 1542	-	Equipment for Eye, Face and Neck Protection Against Non-ionizing Radiation Arising During Welding and Similar Operations
BS 2653	-	Protective Clothing for Welders
DIN 23319	-	Protective Clothing
DIN 51210	-	Face and Eye Protection

Safety Belts and Fall Protection

ANSI A10.14	-	Requirement for Safety Belts, Harnesses, Lanyards, Life Lines and drop Line for Contraction and Industrial Use.
Dupont Eng.	-	S 5 H Safety Belts and Fall Protection Systems Standards.
BS 1397	-	Industrial Safety Belts, Harnesses and Safety Lanyards
DIN 7470	-	Safety Belts
DIN 7474	-	Safety Ropes

Respirators

ANSI Z88.2	-	Practices for Respiratory Protection
BS 2091	-	Respirators for Protection Against Harmful Dust, Gases and Scheduled Agricultural Chemicals
BS 4275	-	Recommendation for the Selections, Use and Maintenance of Respiratory Protective Equipment
BS 4667	-	Breathing Apparatus
DIN 3179	-	Respiratory Equipment Classification
DIN 3188	-	Pressurized Breathing Equipment

Hearing Protection

ANSI S3.19	-	Standard Method of the Measurement of Real Ear Protection of Hearing Protectors and Physical Attenuation of Earmuffs
BS 6344	-	Industrial Hearing Protectors
ISO 1999	-	Assessment of Occupational Noise Exposure for Hearing Conversation Purpose.

- Law No. 1/1970 – Safety in the Workplace
- Decree of Minister of Mines and Energy No. 555.K/26/M.PE/1995 - Safety and Health for Mining

Chapter 2

Section 16: Drilling Preparation, Operations and Production Testing

Contents

16. Drilling Preparation, Operations and Production Testing

16.1 Introduction

16.1.1 Purpose

The safe work practices contained in this section are non-rig specific and therefore some details may not apply. This procedure is to be used as a guide for issue to Contractors and as background information for SUPREME ENERGY (the Company) personnel.

The purpose of this section is to recommend practices and procedures for the promotion and maintenance of safe working conditions for employees engaged in rotary drilling operations and well servicing operations, including special services.

16.1.2 Reference

API RP 54, *American Petroleum Institute, "Recommended Practices for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations", third edition, August 1999,* is to be read in conjunction with this section of the SUPREME ENERGY Safety, Health, and Environment (SHE) Procedures. All Drilling Contractors working at SUPREME ENERGY sites shall hold a copy of this document.

16.1.3 Scope

This section deals with SUPREME ENERGY safety requirements related to:

- pad or drill site preparation.
- drill rig movement, setting up and tearing down within the SUPREME ENERGY area.
- drilling operations involving a rig and third party services.
- post drilling activities such as production testing and wire line activities.

The requirements also pertain to operations dealing with core, production and injection wells drilled into geothermal reservoirs. The operations at SUPREME ENERGY sites will normally be performed under contractual arrangements.

16.1.4 General

The Contractor is responsible for safety at the designated drilling site in accordance with the detailed requirements set out in this section and in the project specific SHE Plan.

High safety standards in drilling and work-over operations will be achieved:

- using well designed and properly laid out equipment.
- using appropriately trained and qualified personnel.
- where the details of the operations are effectively communicated to all levels of personnel.
- using appropriate drilling industry practices.

16.1.5 Standards and Definitions

Unless otherwise stated, the definitions given in API RP 54: "*Recommended Practices for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations"* shall be applicable. Supervisor is further defined to include the Contractor Tool Pusher and the SUPREME ENERGY Drilling Supervisor or "Company Representative".

Drilling Contractors are to conform with all appropriate API RP 54 recommended practices, and, where applicable, MIGAS regulations: "*Recommended Practices for Safe Conduct of Onshore and Offshore Drilling Operations in Indonesia"* (reference KK-01-DJM), in addition to the requirements of this procedure. Where there is conflict between these documents requirements, the stated higher requirements take precedence.

These standards apply to all activities and all parties associated with drilling operations.

All personnel must be fully trained and qualified for the position and work that they carry out.

It is the responsibility of the Contractor's Supervisor for drilling and service contracts to ensure that all safety standards and procedures are readily available to site personnel and to conduct regular site safety meetings.

16.1.6 Control of Place of Work

When SUPREME ENERGY is in charge of the drilling operation, they are responsible for all safety at the drilling site. The SUPREME ENERGY SHE requirements outlined in this section must be complied with.

When the Contractor is in charge of the drilling operation and in control of the place of work, a safety plan that incorporates the requirements of this section as a minimum must be prepared and submitted to SUPREME ENERGY for approval. In this case, the Contractor is responsible for safety at the designated drilling site and SUPREME ENERGY is no longer directly responsible for the drilling operation.

16.2 Drilling Site Preparation

For siting of wells, the effects on existing facilities and operations in terms of safety will be considered by SUPREME ENERGY.

Excavations will be carried out in accordance with the requirements set out in HSE procedure Section …: *Excavations and Shoring*. In addition any operations must be adequately illuminated at night.

Sumps or reservoirs which are likely to retain water or sludge to a depth of more than one meter shall be fenced to prevent the unauthorized persons, general public and animals from entering. All sumps shall be signed with warning notices relating to the changing height of the liquid contents in the sump and the possible hydrogen sulphide gas hazard. It is recommended that, as an aid for someone climbing out of a sump, plastic lined sumps shall be installed with knotted ropes or rope ladders at 3 meters centres along the lined slopes. One end of each rope or ladder must be suitably anchored to the ground outside the sump and the other end shall be no greater than 1 meter off the bottom of the sump.

Conductor pipe shall be installed using safe construction techniques. When installed, all conductor pipes shall be completely covered with steel plate or grate tack welded or padlocked to the pipe.

An adequate water supply shall be available to the site during all drilling and work-over operations. The supply shall be adequate for all quenching, drilling (including drilling without returns of circulation) and cementing operations. It shall have adequate redundancy (storage or standby pumps) to ensure water is available at all times and in sufficient quantities to maintain well control and a safe drilling operation.

The well cellar shall be water tight (e.g. concrete) to prevent pollution. The cellar depth shall be minimized and the cellar shall be well ventilated. Cellars shall be designed and constructed to incorporate a fast and easy means of egress from the cellar floor, both when the rig is operating and following rig removal. Ladders are not acceptable as the sole means of egress. Cellars shall be adequately drained.

16.3 Well Drilling and Services Operations

16.3.1 General

The Contractor will be required to develop, implement and monitor safety program that shall meet or surpass all applicable industry, government and SUPREME ENERGY (outlined in this procedure) standards which include:

- instruction of the Driller or Crew Chief of his/her responsibility for the safety of drilling crews under normal operating and emergency conditions.
- sufficient training of new employees, regardless of prior experience, to the stage that the employee can fill the assigned position in a safe manner.
- instruction of crew members in safe work procedures and practices.
- weekly safety meetings attended by all personnel where crew safety education, hazard identification, problems of the job relating to safety, and related safe practices are discussed.
- good housekeeping practices.
- availability and use of personal protective clothing and equipment.
- contingency and emergency plans suitable for the operation.

Records of safety meeting attendance and topics discussed are to be kept.

A detailed safety inspection of the operation shall be carried out on a monthly basis and a copy of the inspection record (refer to the safety audit checklist for on-shore rigs - at the back of this section). This inspection will be carried out on the first work day of each month. A copy is to be kept on the site file and a copy sent to SUPREME ENERGY.

Contractor shall report their HSE activities to SUPREME ENERGY not later than the 5th day of the month following.

16.3.2 Injuries and First Aid

The Drilling Contractor shall follow first aid procedures the same as, or similar to, SUPREME ENERGY procedures as described in SHE procedure Section …: *First Aid and Medical*.

The SUPREME ENERGY incident and accident reporting procedures outlined in HSE procedure Section …: *Accident and Incident Reporting* are to be followed at all times.

16.3.3 Emergency Preparedness

Emergency drills are to be carried out periodically by all personnel. Topics covered may include, but not limited to, procedures for evacuation and abandonment, H_2S evacuation, firefighting, site stability, well control, kick detection and control and spill response.

16.3.4 Personnel Safety

16.3.4.1 General

Employees shall wear personal protective clothing and use personal protective equipment (PPE) when working in hazardous environments where injury, illness, or death can be prevented by the use of such equipment. SUPREME ENERGY requirements in the use and wearing of safety clothing and equipment are discussed in SHE procedure Section …: *Personal Protective Equipment (PPE)* and the requirements of API RP 54 shall be complied with.

16.3.4.2 Personal Safety Protection and Clothing

- Head protection (safety helmets) shall be worn in all designated hard hat areas.
- Eye protection shall be worn where there is danger of injury to the eyes from flying objects, chemicals, or injurious light or heat rays, etc.
- Safety shoes or boots with toe protection shall be worn. Hot fluids may be inadvertently discharged onto the rig floor or in the vicinity of the rig floor. Footwear with open tops can collect hot fluids during such discharges. Personnel shall ensure that open tops are laced closed or that PVC over trousers lap over the top of the open footwear.
- Protective gloves, aprons, and face visors shall be worn by personnel handling chemicals. Additional PPE (such as respirators) may be required. Refer to the Material Safety Data Sheet (MSDS).
- Loose or poorly fitting clothing, jewelry and other adornments that may catch or snag must not be worn.
- Long hair shall be contained to prevent entanglement.
- Hearing protection shall be worn in high noise areas.
- Respiratory protective equipment shall be worn in any situation where the presence of harmful gases etc, are suspected or known to be present.

16.3.4.3 Safety Equipment and Procedures

All personnel shall obtain permission from the Tool Pusher before going onto the drill floor.

Safety belts with an attached lanyard shall be worn by Derrickmen when handling pipe or casing above derrick floor. A safety harness shall be worn by all personnel when working or climbing aloft.

All equipment shall be maintained in proper working order. Any failure or break-down of equipment shall be reported immediately to the Driller on shift, or to the Tool Pusher.

16.3.5 Visitor Control

All visitors shall report to the site office upon arrival at site.

16.3.6 Smoking

Smoking shall be prohibited at or in the vicinity of operations that constitute a fire hazards. Such locations should be conspicuously posted with a sign, "NO SMOKING OR OPEN FLAME", or equivalent.

Smoking shall be permitted only in areas designated for smoking i.e. outside well pad perimeter fence.

16.3.7 Housekeeping

SUPREME ENERGY safety regulations with respect to housekeeping as outlined in SHE procedure Section …: *Housekeeping* are to be followed. Refer also to Section 6.5 of API RP 54.

Work areas shall be maintained clean and free of debris and tripping hazards.

Adequate means should be provided to convey any hazardous substances away from the rig floor while pulling wet strings of pipe.

Leaks or spill shall be promptly cleaned up to eliminate personnel slipping, fire hazards, and environmental pollution.

If personnel are required to work in a cellar, it should be kept reasonably clear of water, oil, or drilling fluid accumulation. No loose equipment or materials should be in the cellar except equipment or materials in use or about to be used. Personnel are to take appropriate precautions for the presence of hydrogen sulphide gas as outlined in HSE procedure Section …: *Hydrogen Sulphide*, when working in, or entering, cellars.

When placing equipment and tools around the rig floor and drilling location, care should be taken to leave egress routes open.

Tools and equipment should be securely placed and stored in a position or manner so they will not fall.

16.3.8 Flammable and Hazardous Liquids Handling and Storage

For details on the SUPREME ENERGY SHE procedure in the handling, signage and storage of hazardous substances such as fuel and chemicals etc., refer to Section …*: Hazardous Substances*. Refer also to Sections 16 and 6.13 of API RP 54

16.3.9 *Fire Prevention and Protection*

For details on the SUPREME ENERGY SHE procedures in fire prevention and protection, refer to Section …: *Fire Prevention and Fire Fighting Equipment*. Fire prevention and protection is also discussed in Section 7 of API RP 54.

Safe storage and location of combustible and flammable materials and the prevention of accumulation of rubbish are important for fire prevention.

Potential sources of ignition should be permitted only in designated areas at a safe distance from the well head or flammable liquid storage areas.

Fire extinguishers and other fire fighting equipment shall be suitable located, readily accessible, free of obstruction, and plainly labeled as to their type and method of operation.

Crew members shall be familiarized with the location of fire control equipment and selected personnel shall be trained in the use of such equipment.

16.3.10 Personnel Qualification

All drilling personnel shall be fully trained and qualified for the position and work that they carry out.

All training shall include, but not be limited to, the following:

- well control and blow-out preventions.
- firefighting requirements and procedures.
- first aid procedures.
- rig and equipment operations.
- personnel protective equipment.
- emergency and evacuation procedures.
- understanding the health effects of carbon dioxide (CO_2) and hydrogen sulphide (H_2S).

16.3.11 Permits-to-Work

The Contractor is to use a permit-to-work system that is the same or similar to the SUPREME ENERGY Work Permit System. For details refer to Section…: *Permit to Work System* and Section...: *Hot Work*.

16.3.12 Warnings and Other Notices.

Warning notices shall be prominently displayed indicating restriction, safety equipment and first aid station. They shall be written in both Bahasa Indonesian and the English language.

Safe briefing areas (muster stations) are to be established at suitable locations, signed accordingly, and indicated with a green flag.

Information board may be used to display other notices such as, but not limited to, emergency numbers, lesson learn articles, safety committee messages and safety campaign materials.

16.3.13 Machineries and Tools

SUPREME ENERGY SHE procedure for machineries and tools outlined in Section …: *Plant, Systems and Equipment* and Section …: *Safety with Hand Tools and Portable Equipment* are to be followed. Refer also to Section 9 of API RP 54 for drilling and well-servicing equipment.

Machinery shall be operated only when authorized to do so by the Supervisor.

16.3.14 Vehicles

Vehicles not involved in the immediate rig operations should be located a minimum distance of 30 meter from the well bore.

It is preferred that during a drilling operation, vehicles are parked outside the well pad fenced area.

Vehicle parking shall be backward.

16.3.15 Explosives

SUPREME ENERGY SHE procedure on the storage, handling and use of explosives as laid down in Section …: *Hazardous Substances* and the MIGAS publication "*Recommended Practices for Safe Conduct of Explosive Handling in Indonesia" are to be followed.*

16.3.16 Welding and Flame Cutting

Procedures the same as, or similar to, SUPREME ENERGY procedures for welding and flame cutting outlined in Section …: *Hot Work*; are to be followed whenever any such work is to be undertaken.

Field welding shall not be carried out on tongs, elevators, bails or heat-treated rig equipment.

16.3.17 MSDS (Material Safety Data Sheet)

Material safety data sheets shall be provided for all potentially hazardous materials supplied on-site.

16.4 Drilling Equipment and Operations

16.4.1 Equipment Safety

Inspection and testing of equipment is an important factor for the safety of personnel, especially equipment that must be operated when emergencies occur. All equipment shall be regularly inspected and maintained to a high standard. All inspections and tests shall be duly recorded.

16.4.2 Operational Safety

The erection and lay down of derricks and masts should be performed only during day light hours. Otherwise, appropriate strict limitation and precautions shall be established for conducting such activities during night time.

All equipment and materials used on site shall be manufactured, designed, marked to a recognized standard, and certified “safe for use” by an appropriately qualified person.

Prior to any structure being constructed, a foundation analysis shall be performed by an appropriately qualified person and certified “safe for construction”. In addition, the foundation shall be inspected after heavy rains or occurrences that could adversely affect the safety of the structure.

Temporary structures shall be thoroughly inspected during and after erection and weekly thereafter.

Non-destructive test (NDT) inspections are required on selected equipment. The Contractor shall list out the equipment that requires NDT testing and supply the appropriate certificates showing test compliance.

A valid Worthiness certificate (SILO) shall be obtained from Directorate General Energi Baru Terbarukan dan Konservasi Energi (Dirjen EBTKE).

16.4.3 Preliminary Rig Up Operations (Refer also to Section 6.3 of API RP 54)

Prior to commencing rig-up operations, the planned arrangement of all equipment to be placed on the location should be reviewed to eliminate potentially hazardous condition.

Drilling operations shall not be commenced until the rig is rigged in a safe manner.

The rig substructure or derrick mast should be grounded to prevent build-up of static electricity.

Amenity buildings must not be located in the vicinity of rig fuel tanks.

Prior to initiating well servicing operations, the well shall be checked for pressure. Appropriate steps should be taken to remove pressure, or to operate safely under pressure, before commencing operations.

16.4.4 Derricks and Masts

The regulations outlined in the Section 9.2 of API RP 54 shall be followed in addition to the requirements set out below.

16.4.4.1 Erection

All nuts and bolts should initially be tightened to a low torque until the entire structure is completely erected, at which time the bolts and nuts should all be tightened to the correct torque specified by the manufacturer.

All leg sections shall be straight as bent sections have reduced strength and place undue stress on other sections by pulling them out of line.

All erection equipment such as winches, gin poles etc. shall be regularly inspected with records kept of the inspections and shall be used only within their safe working loads.

No other work shall be carried out under the derrick while it is being erected or dismantled or under the mast while it is being raised or lowered. Cellar shall be completely covered during these operations.

16.4.4.2 Derrick Alignment

Eccentric loading of a derrick should be avoided. Due to unequal settling of the derrick corners the center of the water table may not line up with the center of the well. This situation should be rectified by shimming the corners, never by moving the crown block.

16.4.5 Ladders, Stairways, and Platforms

The regulations outlined in the Section 9.3 of API RP 54 shall be followed.

16.4.6 Drawworks

The regulations outlined in Section 9.4 of API RP 54 shall be followed.

16.4.7 Catheads and Lines Powered by the Cathead

The regulations outlined in Section 9.5 of API RP 54 shall be followed.

16.4.8 Hoisting Lines and Other Wire Rope

The regulations outlined in Section 9.6 of API RP 54 shall be followed.

16.4.9 Hoisting Tools, such as Hooks, Bails, Elevators, and Other Related Equipment

The regulations outlined Section 9.7 of API RP 54 shall be followed.

16.4.10 Rotary Table

The regulations outlined in Section 9.16 of API RP 54 shall be followed.

16.4.11 Drill Pipe Slips and Tongs

The regulations outlined in Section 9.9 of API RP 54 shall be followed.

16.4.12 Weight Indicators

The regulations outlined in Section 9.10 of API RP 54 shall be followed.

16.4.13 Drilling Fluid Tanks

The regulations outlined in Section 9.11 of API RP 54 shall be followed.

16.4.14 Pipe Racks

The regulations outlined in Section 9.12 of API RP 54 shall be followed.

16.4.15 Pressure Equipment

The regulations outlined in Section 9.13 of API RP 54 shall be followed.

16.4.16 Generators, Motors, and Lighting

The regulations outlined in Section 9.14 of API RP 54 shall be followed.

16.4.17 Internal Combustion Engines

The regulations outlined in Section 9.15 of API RP 54 shall be followed.

16.4.18 Electrical Systems Equipment

The regulations outlined in Section 10.2 of API RP 54 shall be followed.

16.4.19 Work in Proximity to Exposed Energized Power Sources

The regulations outlined in Section 10.1 of API RP 54 shall be followed.

16.4.20 Land Rig Move

A detailed rig move plan shall be prepared and submitted to SUPREME ENERGY for approval at a reasonable pre-determined time prior to rig move or mobilization. The plan should include full details on route control, equipment size and weight, location, hazardous loads and police escort. In addition, a contingency plan on the above must be prepared.

16.4.21 Wellhead Operations

In all instances, the design working pressure of the wellhead assembly shall not be less than the maximum reservoir pressure at operating conditions.

Removal and/or installation of the wellhead assembly shall be carried out with the required safety equipment in operation or ready for immediate use. When wellhead assemblies are removed, where practically, they shall be broken down, inspected, re-assembled and tested before being re-installed. Following installation, all working components of the assembly shall be operated and pressure tested before removing tubing plugs and opening of surface and subsurface safety equipment.

Before making any minor adjustments to the wellhead assembly, such as gauge changes, the operator will first close all necessary wellheads, flow lines or any other valves which could be a potential pressure source and shall ensure that all pressure is bled off.

16.4.22 Riding Hoisting Equipment

The requirements of Section 6.11 of API RP 54 must be followed.

Personnel may not ride the elevators or catline except in emergency situations or in extreme climatic conditions where, with the appropriate fall protection equipment, it may be safer than ascending or descending the derrick ladders.

The elevators shall be empty of pipe and other equipment while personnel are riding the elevators.

16.4.23 Racking Pipes and Drill Collars

The requirements of Section 6.12 of API RP 54 shall be followed.

Pipe and drill collars racked in the derrick shall be secured to prevent them from falling across the derrick or mast and precautions taken to prevent them from accidentally rolling across the storage rack.

Safety clamps used on drill collars, flush-joint pipe, or similar equipment (to prevent them falling into the well when not held by the elevators) must be removed before hoisting continues.

16.4.24 Blow-Out Prevention Equipment (BOP)

The requirements of Section 6.4 of API RP 54 shall be followed.

i) All necessary precautions shall be taken to keep all wells under control at all times. The following general procedures shall be followed, unless waived or amended by SUPREME ENERGY.

- Blow-out preventers and related well control equipment shall be installed and tested immediately after installation and then at weekly intervals, and be maintained ready for use until drilling operations are completed.
- Temperature-sensitive components such as packing elements and ram rubbers shall be made of material(s) that will resist as high a temperature as necessary.
- All kill lines, blowdown lines, manifolds and fittings shall be constructed of steel or iron and shall under all circumstances have a minimum working pressure and temperature rating exceeding the maximum anticipated surface pressure and temperature.
- Subject to (ii) and (iii) of this Section, blow-out prevention equipment shall have procedurally-operated position selectors and hydraulic actuating systems with accumulators of sufficient capacity to close all of the hydraulically-operated equipment.
- Dual control stations shall be installed with a high-pressure backup system. One control panel shall be located at the driller's station and one control panel shall be located on the ground, at least 15m away from the wellhead or rotary table.
- Air or other gaseous fluid drilling systems shall have blow-out prevention assemblies. Assemblies may include, but are not limited to, a rotating head, a double ram blow-out preventer or equivalent, or a blind ram blow-out preventer or gate valve.

ii. A proposed blow-out prevention program and blow-out contingency plan must be submitted to SUPREME ENERGY by the Rig Contractor and meet the minimum requirements listed below.

- Before drilling below the conductor casing string, at least one remotely controlled annular preventer and flow diverter system

shall be installed. The annular preventer must permit the diversion of geothermal and other fluids.

- Before drilling below the surface, intermediate or production casings, the blow-out prevention equipment installed must include a minimum of:
  - one expansion-type preventer and accumulator or rotating head.
  - both procedure and remote-controlled hydraulically-operated double ram blow-out preventer, or acceptable alternative having a minimum working pressure and temperature rating exceeding maximum anticipated surface pressure and temperature.
  - a drilling spool with side outlets, or equivalent.
  - a fill-up line.
  - a kill line equipped with at least one valve rated for high temperature conditions.
  - a blow down or choke line equipped with at least two valves rated for high temperature conditions and securely anchored at all bends and at the end.

iii. Blow-out equipment shall be tested or inspected in accordance with the following provisions and the results recorded in the drilling log:

- Ram-type blow-out preventers and auxiliary equipment shall be tested to a minimum of 1,000psig (70barg) or to the working pressure of the casing or assembly, whichever is less. Expansion-type blow-out preventers must be tested to 70 percent of the above pressure testing requirements.
- The blow-out prevention equipment shall be pressure tested:
  - when installed.
  - before drilling out plugs and casing shoes.
  - not less than once each week, alternating the control stations.
  - following repairs that require disconnecting a pressure seal in the assembly.
- During drilling operations, blow-out prevention equipment shall be actuated to test proper functioning as follows:
  - once each trip for blind and pipe rams but not less than once each day for pipe rams.
  - at least once each week on the drill pipe for expansion-type preventers.
- All flange bolts shall be inspected at least weekly and tightened as necessary during drilling operations.

- The auxiliary control systems shall be inspected daily to check their mechanical condition and effectiveness.
- Blow-out prevention and auxiliary control equipment shall be cleaned, inspected and, if necessary, repaired before installation.

iv. Blow-out prevention controls shall be plainly labeled. All crew members shall be instructed on the function and operation of this equipment.

v. A blow-out prevention drill shall be conducted periodically for each drilling crew.

vi. A drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted. A kelly cock shall be installed between the kelly and the swivel.

vii. The properties, use and testing of drilling fluids and related drilling procedures shall be adequate to prevent the blow-out of any well. Sufficient drilling fluid materials to ensure well control shall be maintained in the field area and be readily accessible for use at all times. Control and testing procedures are listed below.

- Before pulling the drill pipe, the drilling fluid shall be properly conditioned or displaced. The hole shall be kept reasonably full at all times. The annular mud level should not be deeper than 30 meters from the rotary table when coming out of the hole with drill pipe. Mud cooling techniques shall be utilized when necessary to maintain mud characteristics for proper well control and hole conditioning.
- Mud testing and treatment consistent with good operating practice shall be performed daily or more frequently as conditions warrant. Mud testing equipment shall be maintained on the drilling rig at all times.
- The following drilling fluid system equipment shall be installed and operated continuously during drilling operations:
  - high-low level mud pit indicator including a visual and audio-warning device.
  - degassers, desilters, and desanders, or acceptable alternatives
  - a mechanical, electrical, or procedure surface drilling fluid temperature monitoring device. The temperature of the drilling fluid going into, and coming out of, the hole shall be monitored, read and recorded on the drilling log for a minimum of every 3 meters of hole drilled below the conductor casing.

- a Hydrogen Sulphide (H_2S) indicator and alarm shall be installed in areas suspected or known to contain Hydrogen Sulphide (H_2S) gas which may reach levels considered to be dangerous to the health and safety of personnel in the area.
- a reliable and adequate water supply and rig site water storage shall be maintained at all times when drilling below the surface casing. The suction of each mud pump shall allow for the immediate switching to the rig site water storage when required.

viii. Unless the well is secured with blow-out preventers or cement plugs, a member of the drilling crew or the Toolpusher shall monitor the rig floor from the time drilling operations are initiated through until the well is completed or abandoned.

iv. No exceptions to the requirements of this Section are allowed without the specific prior approval of SUPREME ENERGY.

Note that Items i to iii above are not normally necessary for work overs.

16.4.25 Acidizing, Fracturing, and Hot Oil Operations

The regulations outlined in Section 8 of API RP 54 shall be followed.

16.4.26 Cementing Operations

The regulations outlined in Section 17 of API RP 54 shall be followed.

16.4.27 Gas, Air, or Mist Drilling Operations

The regulations outlined in Section 18 of API RP 54 shall be followed.

16.4.28 Wire Line Work

The regulations outlined in Section 13.7 of API RP 54 shall be followed.

16.4.28.1 General

All wire line equipment to be manufactured or fabricated shall be designed and built to appropriate standards and to withstand the anticipated temperatures, pressures and loads with adequate safety margins.

16.4.28.2 Placement and Handling of Wire line Service Units

The regulations outlined in the relevant section of API RP 54 shall be followed.

16.4.28.3 Gin Poles (Telescoping and Single Poles)

The regulations outlined in relevant section of API RP 54 shall be followed.

16.4.28.4 Rope Falls (Block and Tackle)

The regulations outlined in the relevant section of API RP 54 shall be followed.

16.4.28.5 Wellheads, Wellhead Connections, and Adaptors

The regulations outlined in the relevant section of API RP 54 shall be followed.

16.4.28.6 Lubricators and Wire Line Blow-Out Preventer Equipment

The regulations outlined in the relevant section of API RP 54 shall be followed.

16.4.28.7 Wire Line Operations

The regulations outlined in the relevant section of API RP 54 shall be followed.

16.4.28.8 Perforating (if applicable)

The regulations outlined in the relevant section of API RP 54 shall be followed in addition to the following requirement.

- During wellbore operations, any work requiring the use of explosives (perforating guns, line cutters, etc.) shall be carried out according to SUPREME ENERGY SHE procedure outlined in Section …: *Hazardous Substances*.

16.4.29 Auxiliary Escape

The regulations outlined in Section 6.10 of API RP 54 shall be followed.

On all rigs, prior to personnel working on the derrick, the derrick or mast shall have an auxiliary means of escape from the derrickman's platform installed. Except in an emergency, personnel shall not ride the safety buggy, escape equipment or slide down stands of drill pipe, stands of drill collars, or the deadline to get down the derrick or mast substructure.

Auxiliary escape devices shall be tested after installation to confirm that they are operating correctly.

16.4.30 Hydrogen Sulphide (H_2S) and Drilling

SUPREME ENERGY SHE procedure outlined in Section ...: *Hydrogen Sulphide* are to be complied with.

a) A contingency plan shall be developed when hydrogen sulphide (H_2S) is expected during well operations. The contingency plan should include:

- H_2S monitoring plan.
- pre-alarm conditions.
- designation at briefing areas.
- evacuation plan and notification of authorities.
- a list of medical facilities and contact details.
- personnel to be fully trained.
- procedures for the evacuation of surrounding public areas.

b) Drilling and associated equipment selected for wells where H_2S may be encountered, shall be designed and constructed to comply with recognized standards and specifications.

c) All personnel whose presence is required on a drilling operation where H_2S is anticipated, shall be properly trained and shall have the necessary equipment to prevent exposure to the hazard that can cause serious injury.

16.4.31 Dangerous Area

The area around the drilling rig is considered a "Hazardous Area". Hazardous Area Classification is required to ensure that the area has special precautions developed for control. No unauthorized personnel shall enter the area.

While the installation is under drilling or workover conditions, the following special precautions apply:

i. The standard wellhead pressure test, applicable to the work in hand, shall be repeated every 7 (seven) days.

ii. Warning signs shall be placed around the site and no unauthorized personnel should be permitted in it. Specific site areas may be designated as "NO SMOKING" areas and "NO SMOKING" signs shall be displayed in these areas.

iii) Welding and cutting will be permitted only on issue of a Hot Work Permit (refer to Section …: *Permit to Work System and Section...: Hot Work*).

16.4.32 Abandonment of Wells

Abandonment of a well operation shall not commence without prior approval from SUPREME ENERGY and shall be carried out in accordance with standard industry procedures. A report of abandonment shall be submitted by the

drilling contractor within 30 days from completion of the work and shall include the following:

- notice of intent to abandon well.
- subsequent report of abandonment.
- procedures for permanent abandonment.
- procedures for temporary abandonment.

Installation of the plug shall, where possible, result in the isolation of any potential source of fluid migration from one zone to another within the well bore due to formation pressure differentials. Installation of plugs shall ensure isolation of the well casings from formation pressure.

16.5 Post Drilling Operations

16.5.1 Production Testing

Production testing should commence only if the following conditions are met:

- all test facilities have been fully pressure tested and checked.
- H_2S and abandon location drills have been held.
- lock-out procedure for well/pipeline has been completed as required.

16.5.2 Well Testing and Monitoring

This section deals with the well, after the rig operations have ended, and when it is either left unattended, monitored or tested.

- All valves on a well head shall have their valve wheels or handles removed or locked when the well is unattended. Removed wheels or keys to padlocks shall be left in the care and responsibility of the SUPREME ENERGY authorized personnel.
- Only experienced personnel shall be allowed near the wells and to operate the valves.
- Warning signs indicating the appropriate hazard shall be erected at each well and adjacent to any pipework leading from the well or equipment attached to the well. If the equipment or pipe is un-insulated the warning signs shall indicate a hot pipe hazard.
- When discharging any well, including bleeding, the primary or master valve shall not be used to control the flow. A second valve shall be installed adjacent to the primary or master valve and used to control the flow rate.

- All valves, flanges, spools, tees, elbows and pipework shall be rated for the anticipated temperature and pressure conditions.
- Bleed lines shall be terminated at some distance from the well head to avoid the concentration of hazardous gases in the cellar or in other low lying areas.
- Installation of output test equipment shall be done in a safe manner.
- Where suction can be developed at the open annulus between two concentric pipes (e.g. when a discharge is through a smaller pipe into the larger entry pipe of an atmospheric separator or silencer), then the opening should be covered to prevent material or personnel being pulled into or against the open annulus.
- During well discharges, personnel shall wear safety helmets, safety boots and ear protection when working within 30 meters of any equipment. Wire line work shall be carried in accordance with the relevant clauses in Section 16.4.28 of this procedure.
- Where possible, prior to discharge testing, the well's casing should be allowed to heat-up by bleeding the well through a dedicated bleed line.
- Prior to injection testing, wells are to be quenched as per standard industry practice.
- Good industry practice is to be used during all testing operations to ensure the well casing is not damaged. Such damage could lead to safety implications.

16.6 Safety Audit Checklist

A "Safety Audit Checklist" shall be completed at the beginning of drilling work or as deemed appropriate by SUPREME ENERGY.

A copy of this checklist can be found in the publication MIGAS publication "*Recommended Practices for Safe Conduct of On-shore and Off-shore Drilling Operations in Indonesia (Reference KK-01-DJM), Appendix B - Safety Audit Checklist for Land Rig (Lampiran B - Daftar Pemeriksaan Audit Keselamatan Untuk Instalasi Pemboran Darat)".* For convenience, the "Safety Audit Checklist" is reproduced at the end of this section. The reader should refer back to the original checklist contained in the said Recommended Practices, to ensure the checklist is up to date.

Other safety forms required with respect to drilling safety are listed in the attachments.

ATTACHMENT 1

SAFETY INSPECTION OF ONSHORE DRILLING RIG

DEPARTMENT OF MINES AND ENERGY REPUBLIC OF INDONESIA
DIRECTORATE GENERAL OF RENEWABLE ENERGY AND ENERGY CONSERVATION

COMPANY	**: .....**	**LOCATION**	**: .....**
WORK DESCRIPTION	**: .....**	**WELL**	**: .....**
DRILLING RIG	**: .....**	**DATE**	**: .....**

A . DOCUMENT INSPECTION

1 .Drilling program discussion :……(date/place)
2. K3L Management System : available / not available
3. Drilling installation worthiness certificate No :……
Issued by :……
Validity :……
4. Contingency and Emergency Response Plan : available / not available
5. Measurement instruments calibration document : available / not available
6. UKL/UPL document :available / not available
7. Maintenance Log Book of Rig :available / not available
16. Periodic inspection report of Rig equipment : available / not available
9. Crew competency certification : available / not available
10. Standard Operation Procedures : available / not available

B. VISUAL INSPECTION

1. Condition of drilling safety area (>70 M) : good/not good
2. Warning signs : sufficient/not sufficient
3. Emergency access : sufficient/not sufficient ; good/not good
4. Muster point for emergency situation : available / not available (state how many)
5. Equipment marking : good/not good

C . GENERAL

1. Location condition : good/not good
2. Signboard/well name : available/not available
3. Sign board
   a. No Smoking : available/not available
   b. No Entrance : available/not available
   c. Well condition : good/not good
   d. T-card : available/not available
   e. Display board : available/not available
4. Safety signboard
   a. Safety helmet : available/not available
   b. Safety shoes : available/not available
   c. Mask : available/not available
   d. Safety belt : available/not available
5. House keeping and Cleanliness
   a. Doghouse : good/not good
   b. Engine area : good/not good
   c. Tool house : good/not good
   d. Pump area : good/not good
   e. Mud tank area : good/not good
   f. Work shop : good/not good
   g. Rig floor : good/not good
6. Communication System
   a. Radio : available/not available
   b. Telephone : available/not available
   c. Intercom : available/not available
   d. Hand Phone : available/not available
   e. Public address : available/not available
7. Wind sock : available/not available
16. Welding equipment
   a. Positive connector : available/not available
   b. Negative wire : available/not available
   c. Welding torch : available/not available
   d. Tong : available/not available
   e. Terminal box : available/not available
   f. LPG bottle : available/not available
   g. Oxygen bottle : available/not available
   h. Acetylene bottle : available/not available
   i. Hose condition : available/not available
   j. Gas bottle rack LPG/ Acetylene/Oxygen : available/not available
9. Explosive storage : available/not available
10. Employees
   a.National :.....persons
   b.Expatriate :.....persons
11. Chemical storage : available/not available
12. Survey meter : available/not available

D. INSTALLATION

1. Rig foundation : available/not available
2. Rig floor : available/not available
3. Rig substructure : available/not available
4 Fences : available/not available
5 Ladders : available/not available
6. Mast ladder : available/not available
7 Locking pin : available/not available
16. Deck : available/not available
9 Gin pole : available/not available
10 .Monkey board : available/not available
11. Crown block : available/not available
12. Traveling board : available/not available
13. Stubbing (st) board : available/not available
14. Stopper (st) board : available/not available
15. Guy wire : available/not available
16. Moon line : available/not available
17. Drilling wire : available/not available
116. Rotary hook : available/not available
19. Swivel : available/not available
20. Kelly stop cock : available/not available
21. Rotary hose : available/not available
22. Rotary table : available/not available
23. Elevator & Spider : available/not available
24. Kelly bushing : available/not available
25. Elevator links : available/not available
26. Pipe slips : available/not available
27. Spinning wrench : available/not available
216. Safety clamps : available/not available
29. Rotary tong & Power tong/spin master : available/not available
30. Lift nipples/cup : available/not available
31. Rat hole system : available/not available
32. Steel hammer : available/not available
33. Copper/fiber glass hammer : available/not available
34. Pipe bridge : available/not available
35. Pipe wrenches : available/not available
36. Toe board at rig floor : available/not available
37.Wrenches
    a. Pipe wrenches : available/not available
    b. Chain wrenches : available/not available
    c. Open ended wrenches : available/not available
    d. Ring wrenches : available/not available
316.Chain on Stand pipe & Swivel : available/not available
39. Blow Out Preventer
    a. Annular : available/not available
    b. Pipe rams : available/not available
    c. Blind rams : available/not available
    d. Wellhead connector: available/not available
    e. Flow line : available/not available
    f. Killing line valve : available/not available
    g. Choke line valve : available/not available
    h. Accumulator unit : available/not available
    i. Last test date : ……(dd/mm/yy)
    j. Hydrill annular : available/not available

E. SAFETY EQUIPMENT

1. Escape line : available/not available
2. Escape line anchor : available/not available
3. Escape chair : available/not available
4. Climbing belt : available/not available
5. Safety line on counter weight : available/not available
6. Safety helmet : available/not available
7. Safety shoes : available/not available
16. Safety belt : available/not available
9. Gloves
    a. Leather : available/not available
    b. Rubber : available/not available
    c. Cotton : available/not available
    d. Heat resistant : available/not available
10. Gas Mask at monkey board : available/not available
11. Spare Gas Mask : available/not available
12. Spare of gas canister : available/not available
13. Dust mask : available/not available
14. Air bank : available/not available
15. Gas Detector for H_2S and other toxic gases : available/not available
16. Dust goggles : available/not available
17. Welding goggles : available/not available
116. Stretcher : available/not available
19. Apron : available/not available
20. Ear protector : available/not available
21. Coverall/work clothes: available/not available
22. Fire axes : available/not available
23. Fire blanket : available/not available
24. Fire suits : available/not available
25. Breathing apparatus
    a.SCBA 45 minutes : ……unit
    b.EEBA 10 minutes : ……unit
    c.5 minutes work unit : ……unit
26. Body harness : ……unit
27. Eye wash : ……unit
216. Shower : ……unit

F. FIRE PROTECTION

1. Portable fire extinguisher type	Qty	Last check
a. Dry Powder (ABC type) :	-------	----------
b. CO_2 :	--------	----------
c. Foam :	--------	----------
d. Sand :	---------	----------
e. Sack :	--------	----------
f. Clean agent:	---------	----------
2.Fire pump :	---------	----------
3.Fire monitor :	---------	----------
4.Hoses :	---------	----------
5.Nozzle :	---------	----------
6.Hydrant :	---------	----------

4. Thermometer : available/not available

G. LIFTING EQUIPMENT

1. Brake : good/not good
2. Clutch : good/not good
3. Control buttons : good/not good
4. Cat head : good/not good
5. Speed transmission : good/not good
6. Hydromatic brake : good/not good
7. Weight Indicator : good/not good

H. MOTORS

1.Combustion Engine
- a. Exhaust pipe system : good/not good
- b. Engine/rotating port cover :good/not good
- c. Tank and fuel pipes : good/not good
- d. Exhaust pipe insulator: available/not available
- e. Wire terminal/ insulation : available/not available

2. Electric motor/generator
- a. Switch box/(on/off) : available/not available
- b. Terminal box : available/not available
- c. Circuit breaker/Fuse : available/not available
- d. Ground wire : available/not available
- e. Conductor cable : available/not available
- f. Rotating Parts Cover : available/not available

I. MUD PUMPS

1. V-belt cover : good/not good
2. Safety valves : good/not good
3. Mud pressure pipes : good/not good
4. Shale shaker engine : good/not good
5. Mud tank : good/not good
6. Mud mixer : installed/not installed
7. Manometer : installed/not installed
16. Viscosity meter : installed/not installed
9. Density meter : installed/not installed
10 .Safety chain on discharge hoses : installed/not installed
11. Safety valve set : installed/not installed
12. Mud gun : installed/not installed
13. Settling valve set : installed/not installed
14. Waste disposal pit : installed/not installed
15. Degasser : installed/not installed

J. AIR COMPRESSOR

CONDITION:

1.Air Tank
- a. Working pressure : ……Psi
- b. Date of last inspection:……(dd/mm/yy)

2 Accessories
- a. Wire terminal / insulation : available/not available
- b. Valves : available/not available
- c. Manometer : available/not available

3. Air Hoses/Pipes : available/not available

K. LIGHTING

1. Lamps : good/not good
2. Flood light : good/not good
3. Fog lamps : good/not good
4. Emergency lamp : good/not good
5. Cable installation : good/not good
6. Fuse box : available/not available
7. H_2S sensor at driller consule: available/ not available

L. ALARM SYSTEM

1. General alarm : installed/not installed
2. General alarm switch : installed/not installed
3. Signaling bell : installed/not installed
4. Horn : installed/not installed
5. Sensor near shaker : installed/not installed
6. Sensor near bell nipple : installed/not installed
7. Sensor at driller console/rig floor : installed/not installed

M. CLINIC

1. Doctor/Paramedic : available/not available
2. Medical supplies : available/not available
3. Resuscitator : available/not available
4. Stretcher : available/not available
5. Minor surgery set : available/not available
6. Ambulance : available/not available
7. Automatic external defibrillator : available/not available

N. LIFTING EQUIPMENT

a. **Crawler Crane**
- 1. SKKP No. :.....
- 2. SKKP expiry date : ……
- 3. Issued by : ……
- 4. Owner : ……
- 5. Serial No. : ……
- 6. Model : ……
- 7. Year made : ……
- 16. Maker : ……
- 9. Operator Name : ……
- 10. SIO No : ……
- 11. SIO Eexpiry Date : ……
- 12. Equipment condition: good/not good
- 13. Hydraulic hose condition: good/not good

b. **Forklift**
- 1. SKPP No. : ……
- 2. SKPP expiry date : ……
- 3. Issued by : ……
- 4. Owner : ……
- 5. Serial No. : ……
- 6. Model : ……
- 7. Year made : ……
- 16. Maker : ……
- 9. Operator Name : ……
- 10. SIO No. : ……

11. SIO expiry date : ……

12. Equipment condition: good/not good
13. Hydraulic hose Condition : good/not good

O. PERSONNEL CAMP

1. Physical condition : good/not good
2. Toilet : good/not good
3. Smoke detector : good/not good
4. Ventilation : good/not good
5. General housekeeping : good/not good

P. WASTE TREATMENT

1 Haz Mat storage : available/not available
2. Waste Management : available/not available
3. Sedimentation tank : available/not available
4. Coagulation Tank : available/not available
5. Drilling cut tank : available/not available

Q. ESCAPE ROAD

1. Exit signs : installed/not installed
2. Exit condition : good/not good
3. Location and Escape road map : available/not available

R. FUNCTION TEST TOP DRIVE HIDROLIC

1. Low speed : done/not yet
2. High speed : done/not yet
3. Hydraulic hose connection : done/not yet

COMMENTS/SUGGESTIONS:

1.....

2.....

3.....

4.....

5.....

Approved by :

_____ (Technical Head)

_____ (EBTKE Inspector)

Witnessed by

_____ (Company man)

_____ (Rig Superintendent)

_____ (Safety Representative Company)

ATTACHMENT 2
LAPORAN DUA MINGGUAN

Form LK3-1

DAERAH KEGIATAN : ……
TATA WAKTU : ……
PERUSAHAAN : ……

No. Urut	Perusahaan Pemilik Rig	Nama/Jenis Rig	Lapangan	Nomor Lokasi / Sumur	Jenis Pekerjaan

……, ……20…..
Penyelidik/Kepala Teknik Tambang

(……)

ATTACHMENT 3

SAMPLE OF LAPORAN PENUTUPAN SUMUR PERTAMBANGAN DARATAN

DEPARTEMEN PERTAMBANGAN DAN ENERGI REPUBLIK INDONESIA
DIREKTORAT JENDERAL MINYAK DAN GAS BUMI

Model-Xi

PERUSAHAAN : .....

WILAYAH KERJA : .....

NAMA SUMUR : .....

JENIS SUMUR : .....

KOORDINAT : .....

ELEVASI MEJA PUTAR : .....

KEDALAMAN AKHIR : .....

TANGGAL MULAI DI BOR : .....

TANGGAL SELESAI DI BOR : .....

TANGGAL DITINGGALKAN : .....

JENIS INSTALASI PEMBORAN : .....

PENGAWAS PEMBORAN : .....

ALASAN DITINGGALKAN : .....

PIPA SELUBUNG

Pipa Selubung			Lubang sumur			Penyemenan		Ket.
Ukuran (inch)	Kedalaman		Ukuran (inch)	Kedalaman		Jumlah (sak)	SG slurry (ppg)	
	Dari (ft)	Sampai (ft)		Dari (ft)	Sampai (ft)			

SUMBAT SEMEN

Kedalaman		Penyemenan		SG Lumpur (ppg)	Keterangan
Dari (feet)	Sampai (feet)	Jumlah (sak)*	SG Slurry (ppg)		

TEST PENGUJIAN

No.	Kedalaman (feet)	Choke (feet)	Hasil Test			Tekanan Formasi (psi)	Ket.
			BOPD	MSCFD / GPD	BWPD		

*) sak semen = ... kg

CATATAN LAIN-LAIN :

.....

.....

.....

Chapter 2

Section 17 : Hydrogen Sulfide (H_2S)

Contents

7. Hydrogen Sulfide (H_2S)

7.1 Introduction

Hydrogen Sulfide (H_2S) is a highly toxic chemical compound that is heavier than air in its gaseous form. It is a colorless and a sweetish taste, flammable gas with a pungent (rotten egg) odor at low concentrations. Despite its characteristic odor, sense of smell cannot be relied upon to detect the presence of H_2S because the gas rapidly deadens the sense of smell by paralyzing the olfactory nerve. Exposures to H_2S at concentrations as low as 600 parts per million (ppm) can cause death in a matter of minutes due to paralysis of the respiratory system.

H_2S is a naturally occurring gas that arises from the decomposition of organic material (animal or vegetable) by microorganisms (bacteria). It is found in regions of geothermal activity, occurring around sulphur springs and lakes. It is also found in areas of oil and gas exploitation, in foul sewers and in pools (stagnant water) such as mud ponds, and swamps. Along with carbon dioxide, it is one of the main hazardous components of the non-condensable gas phase associated with geothermal steam. It is possess a significant risk to personnel working in and around geothermal power generation facilities.

7.2 Characteristics

H_2S is a colorless, flammable gas that may be liquefied under pressure. It can occur in a variety of geothermal, oil and gas exploration and production operations, and has the following properties:

- **Toxicity.** H_2S is extremely toxic. The lethal concentration is 600-700 ppm.
- **Heavier than Air.** H_2S is approximately 19 percent heavier than air (vapor density = 1.19). It tends to accumulate in low or enclosed places such as pits, trenches, enclosed well bays and cellars, sumps, the tops of floating roof tanks, buildings, shale shakers and portable containers. However, H_2S mixed with natural gas may form a lighter-than-air mixture.
- **Soluble in Liquids.** High concentrations of H_2S may be present in crude oil, molten sulfur, tank and pit-bottom sludge, produced water, etc., all which may release H_2S when agitated, heated, or depressurized.
- **Odor.** At very low concentrations, H_2S has a characteristic odor suggestive of rotten eggs. However, smell cannot be used as an adequate means of detecting its presence because hydrocarbon vapors in asphalt, bunker fuel and some crude oils can mask the rotten egg odor.

  Additionally, at higher concentrations (>100 ppm), H_2S deadens the sense of smell, leading people to believe falsely that no H_2S is present. Consequently, sense of smell is not dependable as a means of detection.

- **Flammable.** H_2S is an extremely flammable gas with a wide range of flammability (4.3 - 45.5% by volume in air). When burned, H_2S forms sulfur dioxide (SO_2), which is a colorless, highly toxic and very pungent gas.
- **Highly Corrosive.** H_2S accelerates corrosion, producing a general loss of metal and strength, deformation, and cracks. Copper alloys corrode rapidly in H_2S service.
- **Reactive.** In an oxygen-deficient atmosphere, iron and steel will react with H_2S to form iron sulfide deposits on the surface of the metal. Some iron sulfides (known as pyrophoric iron sulfide) are unstable and when exposed to air will undergo a rapidchemical reaction creating an ignition source that should be considered duringequipment shutdowns.

7.3 Health Effects / Toxicity

7.3.1 Health Effects and Exposure Standards

- Depending on the concentration, the effects of acute exposure to H_2S may range from detecting a recognizable odor to causing death
- H_2S oxidizes rapidly in the body; therefore, there are normally no permanent aftereffects from acute exposure if the victim is rescued promptly and resuscitated before experiencing prolonged oxygen deprivation.
- Symptoms from repeated exposures to low concentrations usually disappear after not being exposed for a period of time.
- There is little or no data on the effects of chronic exposure; however, frequentexposures to low concentrations that do not produce effects initially may eventually lead to irritation of the eyes, nose, and throat.

7.3.2 General Properties

- Colorless gas having an offensive odor (rotten eggs) and sweetish taste.
- Slightly heavier than air with a specific gravity of 1.19 (air = 1.00 at 15^{o}C).
- Highly flammable (auto ignition temperature of 260^{o}C).
- Explosive limits in air 4.3% (Lower Explosive Limit / LEL) to 45.5% (Upper Explosive Limit / UEL) (43,000 ppm to 460,000 ppm volume/volume).
- Moderately soluble in water and alcohol.
- Boiling point is - 60.2^{o}C.
- Flash point is - 83.8^{o}C.
- Corrosive to metals and to a lesser extent masonry and concrete materials
- Toxic to humans.

7.3.3 Human Health Effects and Toxicity

Table 7.1-A (ppm)and Table 7.1-B (mg/m^3) presents human health effects for exposures to a range of H_2S concentrations.

Table 7.1-A: Human Health Effects for Exposures to a Range of H_2S Concentrations (ppm)

H2S in Air By Volume	Remarks
> 1 ppm	Perceptible odor except for masking by other odors.
10 ppm	A small percentage of workers may experience eye irritation. Threshold Limit Value (TLV) for an eight-hour Time-Weighted Average (TWA) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH).
15 ppm	Minimum eye and lung irritation. Short Term Exposure Limit (STEL) as a 15-minute TWA (as recommended by the ACGIH).
50 ppm	Mild eye and throat irritation after one-hour exposure.
100 ppm	Deadens sense of smell in 3 to 15 minutes and may cause coughing, and burning of the eyes and respiratory tract.
200 ppm	Immediate loss of sense of smell. Marked eye and respiratory irritation.
300 ppm	The maximum concentration from which one could escape within 30 minutes without a respirator and without experiencing escape-impairing or irreversible health effects. Generally recognized Immediately Dangerous to Life and Health (IDLH) concentration.
500 ppm	Respiratory disturbances in 2 to 15 minutes. Dizziness, collapse, and unconsciousness after half to one hour.
700 ppm	Loss of consciousness quickly. Breathing will stop and death will result if not rescued promptly.
1,000 ppm	Immediate unconsciousness. Death in three to five minutes.

H_2S causes nuisance from its unpleasant odor at concentrations well below those that cause physical health effects. However, continuous exposure to H_2S reduces a person's sensitivity to it.

Table 7.1-B: Human Health Effects for Exposures to a Range of H_2S Concentrations (mg/m^3)

H_2S Concentrations mg/m^3	Health Effects
0.0002 - 0.002	Level of human detection (depending on H_2S purity).
0.016 - 0.02	Smells like rotten eggs.
15	Eye irritation.
70	Permanent eye damage.
225	Paralyses olfactory so odor is no longer a warning signal of the presence of H_2S.
400	Over stimulates the central nervous system, causing rapid breathing, followed by cessation of breathing, convulsions and unconsciousness.
1400	It is lethal (Immediate unconsciousness, death in three to five minutes).

Little information is available on the effect of chronic exposure to H_2S. Adverse effects have been observed in occupationally exposed populations at average concentrations of 15 to $30mg/m^3$. Symptoms include restlessness, lack of vigor, and frequent illness. In occupationally exposed groups, at concentration of $30mg/m^3$ or more, 70% complained of fatigue, somnolence, headache, irritability, poor memory, anxiety, dizziness, and eye irritation.

7.4 Occupational Health Exposure Standards

Occupational health exposure standards for individuals exposed in the workplace to various chemical compounds have been set by a range of governmental organizations. These standards are commonly referred to as Threshold Limit Values (TLV) or Workplace Exposure Standards.

The American Conference of Governmental Industrial Hygienists (ACGIH) *Threshold Limit Values and Biological Exposure Indices* is regarded by most western international occupational safety and health organizations as the benchmark document for the setting of occupational health standards for worker exposure to chemicals.

The 1993-94 Threshold Limit Values for hydrogen sulfide are as follows:

- TLV-TWA 10 ppm ($14 mg/m^3$)
- TLV-STEL 15 ppm ($21 mg/m^3$)

The TLV (Threshold Limit Value - Time Weighted Average) is defined as the time weighted average concentration for a normal eight hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse health effects.

The TLV-STEL (Threshold Limit Value - Short Term Exposure Limit) is defined as the 15-minute time-average which should not be exceeded at any time during the work day even if the eight hour time-weighted average is within the TLV-TWA. Exposures for the TLV-STEL should not be longer than 15-minutes and should not be repeated more than four times per day, with at least 60-minutes between successive exposures to the STEL.

A worker will be required to wear respiratory protective equipment for exposures to hydrogen sulfide concentrations exceeding 50% of the published Threshold Limit Values.

Steps in determining what respiratory protection is required to protect against a known H_2S concentration are presented in **Table 7.2**.

Table 7.2 : Hierarchy of Respiratory Protection for H_2S Exposure

Concentration	Activity	Respiratory Equipment Requirements
≤ 10 ppm	• Entry for work or rescue, < 8 hours only • Emergency egress	Respiratory protection not required but personalexposures should becontinuously monitoredwhenever H_2S hazards may exist.
> 10 ppm, < 300 ppm	• Entry is permitted forwork or rescue • Emergency egress	• Self-contained, positive-pressure breathingequipment (SCBA) • Positive-pressure/pressure-demand air-line breathing equipment coupled with a SCBA rated for a minimum of fifteen minutes • Positive-pressure / pressure-demand air line breathing equipment with an auxiliary self-contained air supply rated for a minimum of 5 minutes if the air-line is connected to a source of breathing air
> 300 ppm	No entry except for rescue • Emergency egress	Requires the same equipment as above (> 10 ppm) but also with a second SCBA-equipped personnearby in a safe area for rescue.
Note: Gas mask canister-type or air purifying (negative pressure) respirators are not recommended for controlling exposures to H_2S.		

7.5 H_2S Hazardous Activity

7.5.1 Hazardous Areas

There are areas / activities at each site where hydrogen sulfide could be encountered at a concentration that poses a significant hazard to workers, for which safe work practices and permit-to-work systems will need to be rigorously adhered to.

These areas should be identified as part of the sites hazard identification and assessment process, and recorded on the Site's Hazard Identification Register (see Section …: *Hazard Identification, Assessment and Control*) :

- Process vessels and related equipment, condensers, cooling towers and boilers.
- Spaces and areas located below ground such as basements, hot well pits, wellhead cellars, vaults, excavated ditches and holes.
- Enclosed spaces such as steamlines, sewers, sewer manholes, wet wells, and vessels.
- Areas near to lines, rock mufflers, silencers, etc. at which vent gases may contain hydrogen sulfide.
- Any ditch or opened topped vault where air circulation is poor so hydrogen sulfide can accumulate at the bottom.
- Degasser, mud tank, mud pond and trip tank.

7.5.2 Designated Hazardous Areas

Areas where there is potential for hydrogen sulfide to accumulate and pose a risk to worker safety will be identified at the site.

Personnel trained in working in areas where hydrogen sulfide may be present and holding the appropriate Permit-To-Work (PTW), shall be authorized to undertake work in the hydrogen sulfide Designated Hazardous Areas. Specific actions with regard to work control and for entering a confined space are detailed in Section …: *Work Control* and Section …: *Confined Space*.

7.5.3 Work In and Around an Area with Hydrogen Sulfide Present

The following general safe work practices should be observed by all personnel working in an area where a hydrogen sulfide gas hazard may be present. Specific safe work practices shall be adhered to for work in Designated Hazardous areas.

- When approaching a job site, check for any obvious sources / signs / smells of hydrogen sulfide.
- Check the general condition flags and sign posted (for hazardous area, displays "Danger" and "Poison Gas" signs) at the site:

  - red — Condition III - extreme danger to life. H_2S has reached injurious levels (above 50 ppm). Do not enter area.
  - yellow/black — Condition II - moderate danger to life. This condition is when H_2S is 10 to 49 ppm. Non-essential personnel shall proceed to Safe Briefing Areas.
  - yellow — Condition I - caution, possible H_2S hazard.
  - green — Safe to work / enter

- Identify the location of the nearest "Safe Briefing Areas" which will be sign posted.
- Check the wind direction by observing the wind socks and streams which are located throughout the site. Wind socks should be checked on a regular basis throughout the working shift, to ensure changes in wind direction are not overlooked.
- Remember H_2S is heavier than air, so avoid low lying areas. If an area or trench is suspected of containing H_2S gas, do not enter without following Permit-To-Work procedures. Gas testing must be performed before entering. The test results shall be written on the permit.
- Observe all warning signs at the site (as specified above).
- Do not attempt to enter any restricted Designated Hazardous Area without the appropriate authorization.
- Be aware of the location of emergency escape breathing apparatus (EEBA).
- In the event of an emergency, follow the site's excavation drills, which you must know.

Emergency Action:

- Should you encounter someone overcome by H_2S, **DO NOT ATTEMPT TO RESCUE THE PERSON.** Only persons wearing Self Contained Breathing Apparatus should enter the area.
- As quickly and as safely as you can, raise the alarm.

- Advise emergency personnel of the location of the incident and number of personnel involved.
- Let the personnel trained in emergency rescue, etc. to carry out the rescue.

7.5.4 Specific Site Work Practices

For all personnel entering Designated Hazardous Areas or equipment where hydrogen sulfide is a known potential hazard, the Permit-To-Work system shall be followed at all times.

For entry into confined spaces, the requirements of the confined space permit-to-work and entry permits shall be followed. These permits and the steps required in actioning them are detailed in Section …: *Work Control* and Section …: *ConfinedSpace.* Please refer to these sections.

7.6 Hydrogen Sulfide Detection / Monitoring

Hydrogen sulfide levels should be monitored in any work area that may reasonably be expected to exceed an atmospheric concentration of 5 ppm (one-half of the Threshold Limit Value). Two broad categories of monitoring devices available: fixed systems and portable units. There are three types of monitoring systems currently used to detect / monitor hydrogen sulfide concentrations.

7.6.1 Fixed Monitoring System

This system is commonly used in a process or drilling environment and is used to detect leaks / failures from equipment, e.g. wellhead, condenser. The main features of the system are listed below:

- Fixed monitoring systems, which continuously measure the concentration of H_2S in an atmosphere, should be installed in facilities containing process equipment handling steam / gases or fluids containing H_2S when the locations are both an enclosed area (room, building, or space) and are inadequately ventilated. (Inadequately ventilated is defined as ventilation that is not sufficient to prevent the accumulation of H_2S in concentrations exceeding 10 ppm.)
- A number of electronic sensors are placed at strategic locations in the workplace.
- The sensors send an electronic signed to a master control system which, via a computer terminal or screen, displays the H_2S concentration recorded for each sensor.

- The H_2S concentration is usually measured as parts per million (ppm) and alarm points can be set, so when H_2S concentration exceed the TLV / Workplace Exposure Standard (10 ppm), a Hi alarm is activated with a general evacuation alarm (Hi-Hi) set when the H_2S concentration exceeds 20 ppm.

A single Hi indication will initiate a Control Room alarm and two Hi's or a single Hi-Hi will initiate appropriate automatic shutdown of wells or production train, as appropriate.

Audio visual alarms will be installed in areas where fixed monitors are installed (wellheads, condenser area). The audio visual alarms will coincide with alarm signals generated by the fixed H_2S monitoring system. They will be distinct in sound and color from all other alarms at the site.

The drawback of such a system is that it is primarily designed to detect process leaks and covers only a small percentage of the workplace. The positioning of sensors is critical if one is to use such a system for personnel protection.

Note: In all instances, one should manually test the atmosphere using a personal H_2S monitor or personal gas detector prior to entry, to verify that the Fixed Monitor System reading is correct.

7.6.2 Personal Portable H_2S Monitor

- Personal electronic monitors are small devices designed to fit in a shirt pocket or attach to a belt to provide personnel with monitoring and early warning of an H_2S release in their immediate work area
- Personal electronic monitors should be used when the atmospheric concentration of H_2S in a person's immediate work area could exceed 10 ppm and fixed monitoring systems are not installed or do not provide adequate coverage of the immediate area
- These units are electronic, using electrochemical cells and are usually hand-held or belt mounted.
- The measure H_2S concentrations continuously, providing a digital read out of the concentration in ppm.
- They are fitted with audible alarms which are activated when concentration exceed a predetermined action level, usually TLV-TWA.
- Monitors should be held or worn as low as possible, definitely no higher than the waist.

7.6.3 Personal Detectors

There are a number of personal detectors that can be used. These units are usually supplied with a hose extension which allows the base of wells, sumps, cellars, etc. to be tested without the testing personnel having to enter the potentially contaminated work area.

Portable H_2S Detectors use a battery-operated pump to pull air / gas samples to a sensor. They can be used with an extendable wand and hose to test an atmosphere without requiring a person to enter the area.

Portable H_2S detectors are generally used to test spaces for the presence of H_2S before conducting work in the area and to search out release sources.

Two common type of devices are listed below.

i) Colorimetric Tape Detector Unit

This unit takes a sample of gas, passes the gas onto a reaction chamber and, via a reaction mechanism, and produces a stain on a tape. The color and depth of the stain indicates the concentrations of H_2S.

These units are not suitable for high concentrations, as they are primarily used to measure low concentrations of H_2S in ambient air.

ii) Colorimetric Tube Gas Detector

This type of unit incorporates a pump, colorimetric detector fuse and a scale for reading of three concentrations of H_2S detector. There are a number of commercial types available, with the most common being Drager and Gastec.

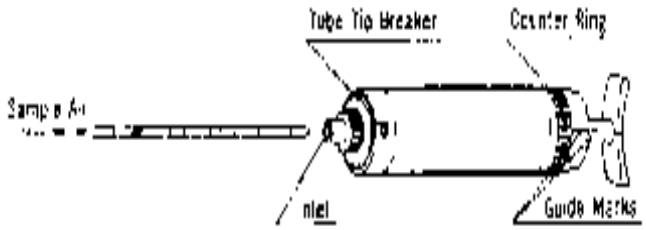


Figure 7.2 Typical Colorimetric Tube Gas Detector

7.6.4 Procedure for Using Colorimetric Tube Gas Detector

Typical sampling and measurement procedure is detailed below:

Set Up

1. Break tips off a fresh detector tube by bending each tube end in the tube tip breaker of the pump.
2. Insert tube securely into pump inlet with arrow on tube pointing toward pump.

To Sample Air

3. Make certain pump handle is all the way in. Align guide marks on pump body and handle.
4. Pull handle out to desired stroke volume. Handle can be locked on either ½ pump stroke (50 ml) or one pump stroke (100 ml).
5. Read concentration at the interface of stained-to-unstained reagent when staining stops. Unlock handle by making ¼ turn and return it to starting position.
6. Where more pump strokes are indicated in the instruction sheet included in each box of tubes, take additional sample by repeating pump strokes without removing tube.

An extension hose can be used to detect gas concentration in vessels and sumps, etc.

Measurements shall be carried out only by persons trained in the correct use of the gas detector.

7.7 Maintenance and Calibration of H_2S Monitors

Due to the hazard poised by equipment failure, all H_2S monitoring equipment will be inspected on a regular basis for defects and corrosion. This work will be undertaken by SUPREME ENERGY equipment Technicians.

Fixed and portable monitors will be routinely calibrated and maintained in accordance with manufacturer's requirements to ensure that H_2S monitoring and alarm systems continue to operate properly.

Calibration records will be kept to show when the unit was calibrated, by whom and the results of the tests. Only trained personnel should calibrate, test, and conduct maintenance on monitoring equipment. Since known concentrations of

H_2S are utilized to calibrate monitoring equipment, such work should only be carried out in well-ventilated areas.

7.8 Ventilation

Hydrogen sulfide (SG = 1.19) is one to two times heavier than air and does not readily dissipate. It tends to accumulate in low lying areas and confined spaces. As stated earlier, these areas must be tested for H_2S concentrations before entering.

If areas are found to contain H_2S, forced ventilation can be applied to remove the accumulated gas and make the areas safe for entering. See Section …: *Confined Space* for further details.

7.9 Training

All employees subject to H_2S exposure in their work areas should receive appropriate initial and periodic training that addresses the following:

- Hazards, characteristics, and properties of H_2S.
- Sources of H_2S.
- Proper use of H_2S detection methods used in the workplace.
- Symptoms of H_2S exposure.
- Rescue techniques and first aid to victims of H_2S exposure.
- Proper use and maintenance of breathing equipment including fit testing and demonstrating proficiency by donning equipment.
- Workplace practices and relevant maintenance procedures that have been established to protect personnel from the hazards of H_2S.
- Wind direction awareness and routes of egress.
- Recognition of and proper response to warning signals or alarms and procedures to follow during an alarm condition.
- Locations of emergency assembly areas and shelter-in-place locations.
- Employees should also participate in periodic drills to practice using breathing apparatus and rescuing workers. Contractors should be required to provide training to their employees unless the Company agrees to do so.
- H_2S trained personnel should receive badge-sized plastic laminated certificates that should be shown when entering H_2S restricted areas.

Chapter 2: Section 18 : Permit-to-Work System

Content

6. Permit-to-Work System

6.1 Introduction

This procedure shall cover all SUPREME ENERGY non-routine activities such as maintenance or repair work that may contain any significant hazards under any specific circumstances. Routine activities shall refer to relevant Standard Operating Procedures.

As discussed in the hazard identification section of this procedure, activities or work carried out at a facility will invariably involve hazards that could lead in injury. It is therefore important that all work is controlled in a manner that will ensure safety. Clearly this control must be practical and enable the work to be completed effectively and efficiently.

6.2 Appropriate Control Measures

Work that is related directly to the purpose of the facility can be expected to be performed repeatedly under known conditions (e.g. synchronizing supplies, changing over production wells). It is therefore possible to assess the associated hazards and set out any necessary precautions. However, some work such as defect repair may have to be carried under a range of differing conditions and therefore hazards. The precautions necessary to ensure safety cannot therefore be fully developed beforehand and so need to be considered at the work planning stage. Work control for this 'abnormal' or 'non-routine' type of work therefore needs to be quite different to that for 'normal' plant operation.

Typical activity-based work control measures can be summarized as:

- All activities
  - Hazardous Area Access Permits
  - Special Procedure Forms
  - Safe Work Practices
  - Technical Instructions
  - Work Permits
- Operation of high energy systems (e.g. steam systems, hydraulic services, power plant)
  - Standard Operating Procedures (SOPs)
  - Emergency Operating Procedures (EOPs)
  - Standing Orders

- Maintenance and repair
  - Work Permits
- Commissioning/Testing
  - Special Technical Procedures
  - Test Procedures
- Major Works (construction, drilling, overhaul)
  - Contractual requirements
  - Work Permits.

6.3 Definition

6.3.1 *Non-routine activities*

Non-routine refers to any activity that is outside regular operation of the plant or installation that is not covered by Standard Operating Procedures; or where persons may be put at risk due to location, surrounding conditions, hazards or other activities. In this respect maintenance and construction activities are considered as non-routine. A permit is required prior to any non-routine activity, even if frequently carried out. If there is any doubt regarding the need to raise a permit then one should be used.

6.3.2 *Permit-to-Work*

Is a signed statement by 'Authorized Person' and 'Performing Person' and authorized by Operational Supervisor that a particular job will be carried out according to stated precautions and under specific conditions within a specified period of time.

6.3.3 *Hot Work*

Refers to any activity that involves the generation of intense heat such as welding, grinding, flame cutting, or use of non-intrinsically safe electrical equipment at the area where existence of flammable material is possible

6.3.4 *Confined Space Entry*

Refers to any enclosed or partially enclosed space, either above or below ground, where there is some risk of reduced oxygen supply or accumulation of non-condensable gasses, toxic materials, steam exposure, flammable or explosive materials, or where means of entry or exit are limited.

6.3.5 *Hazardous Areas*

Refers to certain areas that because of the nature of hazards are identified in that area.

6.3.6 *Excavation work*

Refers to any activities to move ground in order to make a hole or channel or sloping, etc. on the ground by digging more than 30-centimeter depth.

6.4 Special Technical Procedures and Test Procedures

Complex work on systems and equipment such as during commissioning and testing often involves personnel following non-standard procedures and sequences. In addition, during testing, systems and equipment may be subjected to conditions that are nearer to those which they were designed to withstand. As a result the hazards faced by personnel during these times are higher than normal. These increased hazards therefore need to be managed with particular care.

Whenever unusually complex or unusual work is intended to be carried out on systems or equipment, a special procedure is to be written. This is to be written by an engineer of suitable experience and reviewed by a group of personnel drawn from all affected disciplines. Such a group shall consider hazard management and safety as a separate agenda item before authorizing the use of a procedure. The Site SHE Representative is to be an ex-officio member of all such special procedure groups.

Once proven in use, special procedures are to be registered and retained to form the bases of future special procedures. All such procedures are to be reviewed prior to re-issue to ensure all assumptions made regarding prior conditions are still relevant and correct.

6.5 Permit-to-Work System

6.5.1 *Introduction*

Formal Permit-to-Work systems, developed through many years' experience, are a major factor in the safety of mining industries including geothermal, oil and gas, chemical and power generation.

The system used by SUPREME ENERGY draws on this prior experience and is designed to ensure safety within a practical and efficient level of control. The system is to be reviewed by SUPREME ENERGY management from time to time and if necessary refined in the light of reports from site Safety, Health and Environmental Committees.

6.5.2 *Permit-to-Work Overview*

Work Permit

Signed statement by an authorized person that a particular job may be carried out with stated precautions. Permits are designed to aid safe job planning and coordination.

General Work Permit (GWP)

The main permit raised for each job. Other specific permits may be used to support it.

Specific Work Permits and Plans

Specialized permits that cover specific types of situations or areas. Plans aid work planning in the same way as permits, but do not need to be authorized by a technical or area supervisor.

Certificate

Signed statement that specifies checks or tests have been carried out by an authorized person and that conditions are acceptable, (e.g. Gas Test Certificate). Certificates do not replace permits; they are complementary.

High Voltage

High voltage is the term applied to electrical equipment that operates at more than 600 volts (terminal to terminal), or more than 300 volts (terminal to earth). High current AC or DC power supplies are to be considered as High Voltage. See Section …: *Electrical Safety* for further information.

Permit Applicant

The person who is raises a permit. This is always the SUPREME ENERGY employee or contractor in direct charge of the work or immediate work site. They are to be of an appropriate engineering discipline. Where the job involves work on High Voltage equipment or systems, the permit applicant must be an electrical engineer.

Performing Person / Permit Holder

The person who is in charge of the job and who formally holds the authorized permit. The permit applicant becomes the permit holder when the permit is authorized.

Operational Supervisor

The leader of the section of the installation authorized by the Company grant General Work Permits in the area concerned. The area should be a defined section of the installation (usually defined by the system or service covered). The Operational Supervisor will usually be the line or department supervisor directly responsible for the physical operation of that section of the installation.

Area Supervisor/Authorized Person

The person authorized by the Company to grant Hazardous Area / General Work Permits, for areas where they hold specific responsibility. This authority to grant area permits may be delegated to suitably qualified personnel.

Technical Supervisor

The person with particular training and knowledge authorized by the Company to grant Specific Work Permits.

Shift Supervisor

The operations employee with current responsibility for the operation of the installation or section thereof. Out of normal working hours this person is likely to have operational responsibility for the whole site.

Authorized Gas Tester

This term is used to describe a person who is trained to perform gas tests and authorized to issue Gas Test Certificates (in support of specific work permits, etc.).

6.5.3 *Intent and Applicability*

Permit-to-Work system is intended to reduce the chance of misunderstandings when 'non-routine' activities are to be carried out on operational plant, systems or equipment, or where normal activities are carried out under 'non-standard' conditions. These are situations where unknown or un-assessed hazards may occur. In doing so it attempts to safeguard people and property. The system is to be used within all SUPREME ENERGY operational facilities. The term 'non-routine' is defined under Definitions above.

An example of when a work permit may or may not be required is that of painting. A permit clearly is not appropriate to paint the ground floor windows of an administrative building. However, if the same otherwise safe activity was to be carried on an explosives store, a permit would enable suitable precautions to be put in place to safeguard the personnel and site.

The Permit-to-Work is a system that enables work to be planned and authorized to allow all associated hazards to be considered and the risks mitigated. The Permit-to-Work system does not in itself make the job safe; that can only be achieved by the persons using the system and carrying out the activity.

The same permit system is to be used to control work being carried out by SUPREME ENERGY personnel and contractors alike. The only place and time it may not apply is when an area has been designated a contractor-controlled area. In these cases, alternative permit systems that meet SUPREME ENERGY contractual requirements will be used and / or stated on agreed Bridging Document. However, it is of note that a General Work Permit (GWP) may be appropriate to manage the isolation boundary around a construction or drilling site.

6.5.4 *Aim of Permit System*

The aim of the permit system is to;

- prevent harm to individuals or plant during 'non-routine' activities
- allow proper co-ordination of site activities

This is achieved by;

- ensuring proper authorization of non-routine or hazardous work
- aiding complete job planning
- setting time, scope and area limits
- facilitating hazard identification, assessment and mitigation
- facilitating the obtaining of second opinion to reduce the chance of errors
- ensuring information exchange and work co-ordination
- aiding job and team briefing.

6.5.5 *Training*

All personnel, whether employees or contractors, who may be required to carry out work within SUPREME ENERGY' installations are to be aware of the permit-to-work system.

The minimum level of awareness shall include:

- basic outline of how the permit system functions and why
- there is a General Work Permit supported by additional specific permits
- tags are and that they must never be ignored
- a tag-out and lock-out system is used
- who to ask if in doubt.

All personnel who are expected to work regularly under the control of permits are to have additional training that shall include the items listed below:

- What permits are used, when they are used, what information they hold, and how they link to the General Work Permit.
- How to check that the appropriate permit is in force and what hazard controls have been put in place.
- Where original permits are held and where to expect to see copies posted.
- What tags are used on site, and what information they convey.
- How the tag-out/lock-out system is used and how to check that a system is safe to work on.

Any personnel who may be expected to be put in charge of work requiring permits to be raised may be required to become a Permit Holder. To this end all such persons are to be fully trained in the completion and use of permits, tags, and lockouts. The same requirement applies to Supervisors and the site safety staff.

6.6 Fundamental Approach

The Permit-to-Work system is based upon a structured, systematic and disciplined approach to work planning that enables work to be correctly organized and co-ordinated. In particular, it requires all associated hazards and the necessary precautions to be identified. Permits are designed principally to aid safe work planning and hazard management.

The Permit-to-Work system is built around a General Work Permit (GWP) Form that is supported by additional specific permits when required. The General Work Permit allows the appropriate level of control and planning to be applied: minimal control on simple low-risk activities, and graduating to strict and sometimes involved control on potentially high-risk undertakings.

The work planning method outlined in this section follows a clearly defined and formalized process that aids the professional thought process that a worker should naturally apply prior to commencing a job. It consists of a series of fundamental steps, namely:

- work scoping and planning (what, when, who, how, etc.)
- hazard/risk identification and management
- authorization
- making systems and equipment safe
- execution of work
- re-commissioning.

6.6.1 *Permits and Associated Documentation*

The permits, certificates, and plans are:

- General Work Permit
- Hazardous Area Permit
- Specific Work Permit:
  - Hot Work Permit
  - Confined Space Entry Permit
  - Excavation Plan
  - Change Permit (whenever require).
- Atmospheric Testing Certificate
- Electrical Isolation Certificate

The specific work plans are:

- Scaffolding Plan
- Mobil Crane Plan
- Purging Plan

Associated documentation required by the permit system includes:

- Hazard/risk identification
- General Permit Log
- Site/Field/Plant Status Boards
- Tag-out Tags
- Caution Tags
- Test Forms
- 'Awaiting Test' Log

Copies of the General Work Permit, Hazardous Area Permit, Specific Work Permits, and Certificates are at the end of this section (see Appendixes).

Other permits are presented in the appropriate sections of this procedure. Additional information required by to those raising permits includes:

- system diagrams
- site plans
- site/field/plant status (from boards/control screens, etc.).

Additional hardware is required by the Lockout/Tag-out system that accompanies the permits. This includes:

- padlocks (individually keyed and numbered)
- locking chain
- purpose-designed locking devices
- built-in locking facilities
- lockable key boxes
- master key boards
- wall mounted system status boards.

6.6.2 *Control of Permits*

The correct administrative control of permits is fundamental to the safe working of the system. Permits are to be managed from a minimum number of points. Normally this will be the main plant control room. If more than one permit control point is used then a clear demarcation of responsibility is to be stated with the main plant control point remaining the lead point, where a master log of all permits raised is to maintain.

6.6.3 *General Work Permit (GWP)*

The General Work Permit consists of a single A4 sheet (see *Appendix 3 – General Work Permit*). It is divided into a number of sections that reflect the work planning process. As stated before the GWP is designed to form a planning frame work to ensure that all 'non-routine' work, or other work performed within a 'nonstandard' situation is carried out safely. In particular, it facilitates a systematic hazard identification and assessment process, as well as facilitating a second opinion and authorization step.

The GWP will be initiated by the need to carry out work. This will normally be by a defect report, work request, or other administrative process. GWPs will normally be raised by the maintenance section of the appropriate department.

6.6.4 *General Work Permit Log*

A log book is to be kept at the main control point (usually the plant control room) in which a record of all GWPs is kept (those in force and pending). The log is to record:

- the GWP identity number
- date raised
- the Permit Holder's name
- a brief description of the work
- the system/equipment being worked on
- location of work
- review period (where applicable)
- key box number (if applicable)
- date work started
- date work completed
- review complete boxes.

Example GWP Log headers are reproduced here:

Example of GWP Log (Left Page)

Permit Number	Permit Applicant/Holder	Work System/Equipment Location	Key Box Number

Example of GWP Log (Right Page)

Work Started (Sign/Date)	Review Period	1st Review (Sign/Date)	2nd Review	Work Completed Date

6.6.5 *Completion of General Work Permit (GWP)*

The completion process of using the GWP is shown in the flow process outline in *Appendix 1 – Permit-to-Work Flow Process*.

- Each section is to be completed as required.
- Where there is no information for a section of the form then the reason for the omission is to be noted. For example, if no hazard is posed by any systems then "no isolations required" or other similar note is to be added under the Isolation Boundary section.
- Where it is necessary to use additional pages then 'see attached sheet' is to be noted in the relevant section of the GWP. All of the details relating to that section are then to be shown on the attached sheet. In this way accidental loss of the additional sheet would become obvious.

The following steps are to be carried out by the Permit Applicant when raising a GWP:

1. Obtain a sequential permit number from the GWP log (if not pre-printed).
2. Insert the current date, fill the Permit Period, shall be not exceed than ... days.
3. Note the location of the work.
4. Include relevant references to identify the reason that the work is required (e.g. maintenance instruction number, work request number, etc.)
5. Identify and list the equipment and systems to be worked on.
6. Briefly describe the work to be done. Include enough detail to allow a general understanding of the nature and extent of the work.
7. Record the Permit Applicant's name and department. This is always to be the person who will be in direct charge of the work or work site.
8. Note the expected duration of the work. This is the duration from preparing the work site to final completion and anticipated sign-off of the GWP.
9. Discuss the work with the appropriate operators on duty to identify the implications to the plant and systems. State the effect on the plant, systems, services and the site. This is to include the implications on stand-by, back-up, and safety related systems or facilities.

10. Use the prompts given on the GWP to carry out a hazard identification process for the work. This is to relate to the workers directly involved in the work as well as all other employees, contractors, or members of the public. Where the work is complex or particularly hazardous a more comprehensive hazard management planning stage shall be undertaken. (See Section: …: *Hazard Identification, Assessment and Control*).

11. Inspect system drawings to identify the isolation boundary necessary to ensure the work site will be safe. Seek advice from operators / experts, as necessary, to minimize the effect on the plant. List all tag-out tags required, and the isolation points that also require to be locked (see Section …: Tag-out and Lock-out procedures).

12. Consider what other precautions are required such as barriers, signage etc. List them. Include a review period.

13. Consider whether there will be confined energy that will need to be released prior to work. Consider all energy types including pressure, electrical, mechanical, chemical, etc. State how energy will be released, removed or dissipated, and how a safe state will be confirmed.

14. List any tests that will be required before, during, or after the work is complete. Consider all associated safety implications and list all precautions necessary. If testing is complex or hazardous then a separate test procedure shall be used and attached to the GWP. (See Subsection 6.4*: Special Technical Procedures and Test Procedures*.)

15. The Permit Applicant is to take the completed GWP to the Shift/Operational Supervisor for approval and authorization. The supervisor signs to approve the work plan and precautions included therein, to acknowledge that he/she is aware that the work is to be carried out, is in agreement with the permit review period, and that preparations for the work may proceed. He/she thereby releases the equipment or systems for work and up-dates the system status board and control screen as appropriate. It is of note that the Supervisor may require that additional specialists review the plan when unusual or highly specialized hazards or work are involved (e.g. radiography, in situ grinding, etc.).

16. Raise all appropriate Specific Work Permits and Plans to support the work.

17. Complete all preparations to start the work and manage the hazards.

18. Request operators to carry out any system and equipment isolations required (Section …: Tag-out and Lock-out). Complete tag-out/lock-out.

19. Permit Holder briefs the work team. This is a particularly important step as workers cannot keep themselves safe if they do not understand the intended plan or the hazards they face.

20. Sign signature box (iii) to state that hazards have been, or are being, managed (including release of energy), workers have been briefed, and to certify the tag-out/lock-out is enforce.

21. Obtain shift or operational (as appropriate) supervisor's signature and permission to start work.

22. Carry out work while keeping all hazard management precautions under review, and all workers briefed.

23. Carry out any testing required in accordance with the precautions and safeguards previously stated (obtain authorization where required). Record results.

24. Permit Holder to confirm by signing (box (iv)) that all work and testing is complete, and that the equipment/system is ready for commissioning.

25. Permit Holder briefs Shift/Operational Supervisor on the work-site and systems/equipment and requests that systems/equipment be accepted for commissioning. Further testing that needs to be carried out following commissioning, are to be reported. Once the Supervisor is content he/she signs acceptance of the equipment/systems for commissioning. There may be test and/or commissioning requirements that have not, or cannot, be completed immediately due to the state of the plant. Then a note is to be made in an appropriate commissioning/test log to ensure that the requirements will be fulfilled within a specified time period.

26. Permit Holder ensures that all other permits have been signed-off and that the work site is restored to a safe and correct state (see Section …: *Housekeeping*). Sign off Permit Log.

27. Operational Supervisor signs (box (vi)) to acknowledge that the work is complete in all respects, that the test/commissioning log has been completed where appropriate, and to close the GWP.

6.6.6 *Review of Work under a GWP*

When work continues for an extended period (e.g. longer than a week) it is possible that the work situation or surrounding conditions may change. As a result, the original precautions may become inadequate. Additionally, errors may be made that could threaten the safety of personnel, whether involved in the work or not. It is important therefore that reviews are undertaken at appropriate periods to confirm that a safe environment is being maintained.

Setting the Review Period

- The Permit Holder is to suggest a review period based upon the complexity and anticipated duration of the work.

- The Operational Supervisor is to discuss this and modify it as deemed necessary prior to authorizing the work.
- The period is to be entered into the GWP log prior to work starting.

Undertaking the Reviews

- The reviews are to be carried out by the operations section of the relevant department.
- Operational Supervisors are to ensure that personnel instructed to carry out reviews have sufficient understanding of the permit system to identify discrepancies or when unsafe conditions exist.
- The reviews are normally to be undertaken during the quiet hours (out of normal work hours).
- On completion the reviewer is to sign off the appropriate column of the GWP Log noting if any discrepancy has been found.
- Any discrepancies are to be brought immediately to the attention of the Shift Supervisor who will instigate appropriate action to ensure continued personnel and plant safety. This may include the revoking of the GWP, and work being stopped until a new GWP and appropriate permits are raised.

6.6.7 *Change of Permit Holder*

Permit holder should normally be directly in charge of work from start to finish. The work program should be arranged to achieve this whenever possible. However, at times it may be necessary to hand control of work over to another employee or contractor. Such handing over of responsibility can be the source of errors that can in turn lead to unsafe conditions.

It is therefore important that handovers are undertaken with care and at suitably chosen stages as listed below:

- After verbal approval by Operational Supervisor, who originally authorized the GWP, the worker taking over responsibility is to be fully briefed:
  - on the work,
  - the present status,
  - all hazards,
  - all precautions/ controls (if possible by the present Permit holder).
- The replacement, once satisfied that he/she can safely take over control and that all is in order, is to rule through the original applicants name (it is to remain readable) and append their name beside it on both the original GWP and in the GWP Log. He/she should then counter-sign box (ii).

- The Supervisor shall be satisfied that the replacement is fully aware of the work and all precautions and controls.
- Hand-over is finally authorized by the Supervisor initialing against the new applicant's signature on the GWP.

6.6.8 *Hazardous Area Permit*

Due to the nature of standing hazards in some areas, special precautions are necessary. There is a requirement to impose certain controls on these areas. The Hazardous Area Permit system ensures that these controls are met during non-routine work. Examples of the hazards to be present in these areas include high voltage power lines, open water, hazardous chemicals, explosives, etc.

The Hazardous Area Permit is designed to ensure that a person with appropriate knowledge and responsibility (the Area Supervisor) is involved in the planning of work within this area, and authorizes entry for work in the area. A copy of the Hazardous Area Permit (*Appendix 4 – Hazardous Area Entry Permit*) is presented at the end of this section.

6.6.9 *Specific Work Permits and Plans*

Hot Work Permit

Work that generates heat or sparks is potentially very dangerous, particularly within the type of installation operated by SUPREME ENERGY. See Section …: *Hot Work* for an explanation of the use of the Hot Work Permit and a copy of Hot Work Permit (see *Appendix 5 – Hot Work Permit*) is presented at the end of this section.

Confined Space Entry Permit

Work within a confined space, whether it be a tank, vessel, pipe or sump is potentially very hazardous. See Section …: *Confined Space* for an explanation on the use of the Confined Space Entry Permit, together with a copy of the Confined Space Entry Permit (see *Appendix 6 – Confined Space Entry Permit*) is presented at the end of this section.

Excavations Permit

An Excavation Permit is required for all work involving digging more than 30 centimetres depth into the ground or where work is to be carried near to an area prone to slippage. See Section …: *Excavations and Shoring* for an explanation on the use of the Excavation Permit, together with a copy of the Excavation Permit (see *Appendix 7 – Excavation Permit*) is presented at the end of this section.

Mobile Crane Plan

The use of mobile cranes can lead to major hazards that can be difficult to control. Examples of these hazards include crane instability due to ground conditions, damage to underground services and contact with overhead lines. The plan for is designed to help control these hazards. Details of Mobile Crane practices, and the applicable associated permit are address in Section …: *Lifting Equipment and Lifting*.

Scaffolding Plan

Work on or around scaffolding can be hazardous if the scaffolding is not erected correctly. Use of the Scaffolding Plan ensures that suitably qualified personnel are involved in the erection of scaffolding above 5m in height on sites owned and operated by SUPREME ENERGY. Details of safe scaffolding practices, controls, and the applicable associated permit are addressed in Section …: *Working at Height*.

Purge Plan
Purging operations need to be carefully thought through to control the major hazards that are often present. A copy of the Plan form is presented in Section …: *Plant, Systems and Equipment*.

6.6.10 *Changes to GWP Permit*

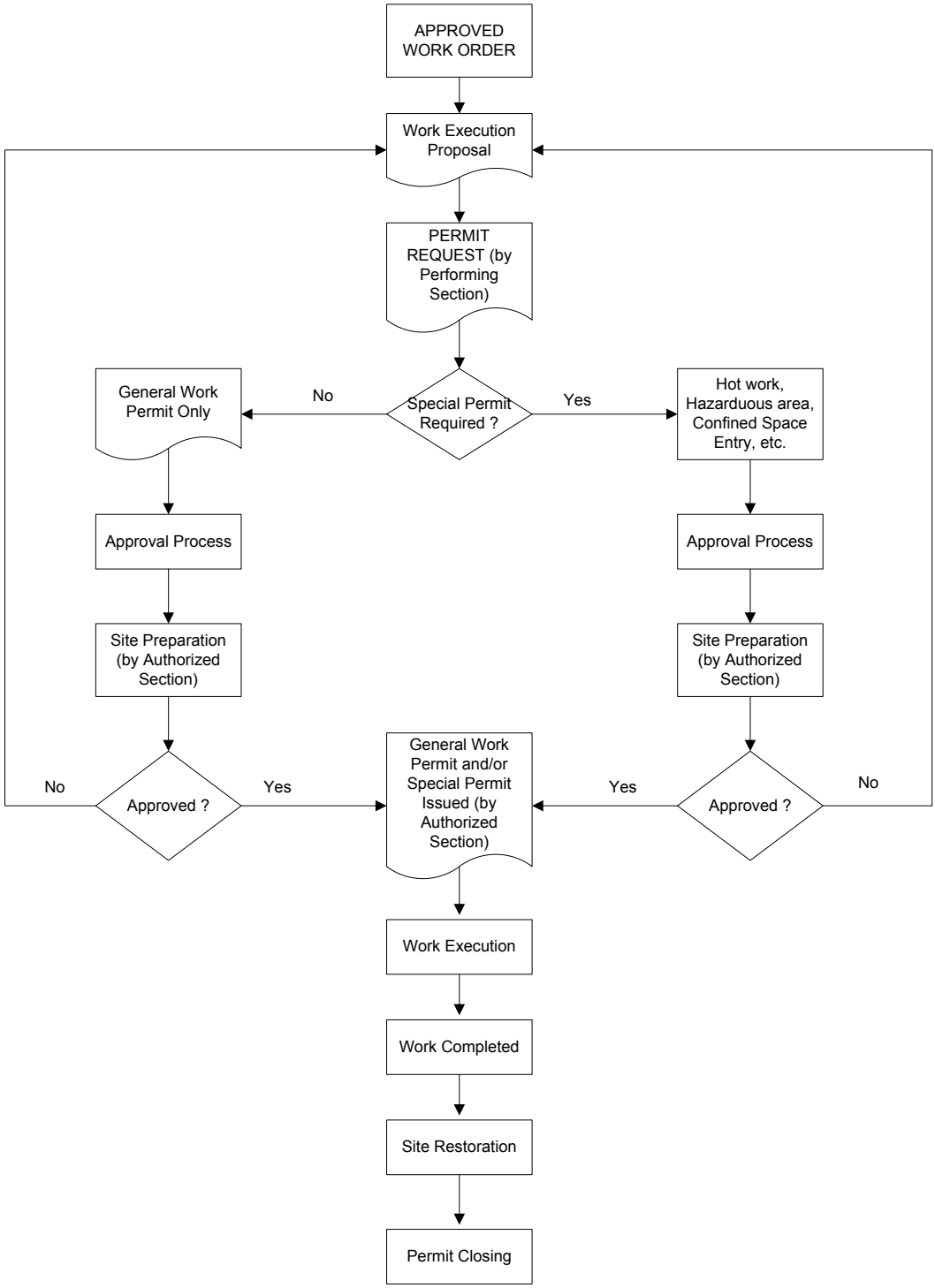
Changes to an existing permit may be necessary for a number of reasons. However, the process of changing the precautions, limitations, or controls put in place by a permit is potentially very risky.

To ensure that the change does not cause an unsafe condition a strict review process is necessary. The Change to Existing Permit (See *Appendix 8 - Change to Existing Work Permit*) aims to ensure the change is planned correctly, all implications have been considered and a review of the proposed changes is carried out by a suitably experienced supervisor.

It is to be used to cover all changes to a General Work Permit, a Hazardous Area Permit or a Specific Work Permit. A copy of the form (See *Appendix 8 - Change to Existing Work Permit*) is presented at end of this section. As the potential for error during a change is significant, this permit is to be produced on yellow paper. It is designed to guide a Permit Applicant through the change process. It is important that whenever possible, the original Permit Applicant completes the change to Existing Permit Form as this person is best placed to understand the work plan, the precautions that were put in place and the implications of the change.

Once completed and authorized the change permit is to be stapled to the original permit and to all copies thereof. The use of yellow paper shall extend to all copies to ensure that the attention of all relevant personnel is drawn to the existence of a change permit.

Appendix 1 – Permit-to-Work Flow Process



Appendix 2 – Permit Request

supreme energy	**PERMIT REQUEST**				
Type of Permit Requested	❑General	❑Hot Work	❑Hazardous Area	❑Confined Space Entry	❑Excavation
Ref. Work Order No : _____	Permit required date : __ / __ / _____		Duration : _____		
Area : _____	System : _____		Location : _____		
Effect on Plant, Service or Sites:					
Brief Description of Work :					
Describe any specific operational preparation required : (e.g.. process isolation, draining venting, purging, gas freeing, electrical isolations)					
Requested by : (name & sign)	Date :				

Appendix 3 – General Work Permit

GWP #: - - - - - - -

GENERAL WORK PERMIT

Issue Date : _____	Valid from _____ (time) Until _____ (time)	
Area/Location :	System :	Equipment :
Description of work :		
Effect on Plant, Service or Sites :		

Nature of hazards:		Precautions			
Stored energy (steam, pressure, electrical)		Isolations in Place		Ground Fault Circuit Interrupter	
Noise		Ventilation		MSDS available	
Toxic substance		Crew Rotation		Scaffolding Inspected	
Heat		Life Lines Installed		Emergency Station	
Elevation		Roads Closed			
Traffic		Mats Installed			
Flammable Vapors		Combustibles Removed			
Ignition Source		Drains covered			
Restricted access		Materials Drained			
Other					

Other Precautions:

Personal Protective Equipment (PPE)

Eye/Ear	Extremities	Fall Protection	Respirator
❑ Goggles ❑ Safety Glasses ❑ Face Shield ❑ Earplug ❑ Muffs	❑ Gloves ❑ Boots ❑ Hard hat ❑ Chemical Resistant	❑ Harness ❑ Lifeline	❑ SCBA ❑ Cartridge ❑ Dusk musk

Other PPE:

Related Specific Work Permit / Certificate

Hot Work Permit	No. #
Confined Space Entry Permit	No. #
Hazardous Area Permit	No. #
Excavation Permit	No. #
Electrical Isolation Certificate	No. #

The location where this work is to be done has been prepared for work, all process isolations are in place, necessary precautions taken, and personnel are aware of their duties, particular hazards and any special precautions and restrictions.
Authorized Person: _____ (name) _____ (signed) _____ (date/time)

I have reviewed and understood all precaution and possible hazards of this work and accepted the condition to commence the work.
Performing Person: _____(name) _____(signed) _____ (date/time)

I have reviewed all preparation and method of work and authorized the permit to be issued
Operational Supervisor : _____ (name)_____ (signed) _____ (date/time)

This permit is extended from _____ (time) until _____ ((time) Authorized Person _____(signed)

from _____ (time) until _____ ((time) Authorized Person _____(signed)

Work Completion

The work have been completed and work site has been restored and cleaned
Performing Person : _____ (name) _____ (signed) _____ (date/time)

Authorized Person: _____ (name) _____ (signed)_____ (date/time)

Appendix 4 – Hazardous Area Entry Permit

HAEP #: - - - - - - -

HAZARDOUS AREA - ENTRY PERMIT

Issue date :	General Work Permit No. #
Valid from_____ (time)	Until _____ (time)
Hazardous Area :	
Reason to enter the area :	

Nature of hazards to personnel :		Personnel Protection Equipment (PPE) required :
Stored Energy (steam, pressure, electrical)		
Ignition Source		
Flammable material		
Explosive material		
Toxic substances		
Elevation / Depth		
Noise		
Heat		
Dust		
Other		

Specific Precaution
:……

The area has been prepared for entry, all necessary process isolations are in place, necessary precautions taken, and personnel are aware of their duties, particular hazards and any special precautions and confirm to be safe for entering. Permission to enter the area is granted.
Authorized Person : _____ (name) _____ (signed) _____ (date/time)

I have reviewed and understood all precaution and possible hazards to enter the area and accepted the condition.
Performing Person : _____ (name) _____ (signed) _____ (date/time)

I have reviewed all preparation and method of work and authorized the permit to be issued
Operational Supervisor : _____ (name) _____ (signed) _____ (date/time)

I understand the entry conditions and all precautions

NAME	SIGNATURE	DATE	IN	OUT	NAME	SIGNATURE	DATE	IN	OUT

PERMIT EXTENSION

This permit is extended from _____ (time) until _____ (time) Authorized Person _____(signed)

from _____ (time) until _____ (time) Authorized Person _____(signed)

WORK COMPLETION

I have confirmed that the work related to this permit have completed. Work area has been cleaned, restored and inspected after the work was completed and were found safe.

Performing Person : _____ (name) _____ (signed) _____ (date/time)

Confirmed that the work have completed and accepted. All safety barriers, signs and any process isolations have been restored.

Authorized Person : _____ (name) _____ (signed) _____ (date/time)

Appendix 5 – Hot Work Permit

HWP #: - - - - - - -

supreme energy	**HOT WORK PERMIT**

Issue date :			General Work Permit No. #		
Valid from _____ (time) Until _____ (time)					
Area/Location :	System :		Equipment:		
Description of work :					
Ignition Source(s):					
Atmospheric Testing Certificate No. #			Result :		
Hazards	Y	N	Precautions	Y	N
Ignition source within 12 meter of fuel source			Charged Fire Hose		
Open drains with Hydrocarbons			Shields, Blankets		
Combustibles in the Area			Drains covered		
Non Intrinsically Safe (IS)			Area Wet		
Welding process			Fire Extinguisher		
Compressed Gas Cylinders			Ventilation		
Radiation			Welding Machine Grounded		
			Welding Equipment Inspected		
			Cylinders secured		
			Continuous Atmospheric Monitoring		
Other Specific Precaution:					

The location where this work is to be done has been examined, necessary precautions taken, and personnel are aware of their duties, particular hazards and any special precautions.
Permission is granted for this work.
Authorized Person : _____ (name) _____ (signed) _____ (date/time)

I have reviewed and understood all precautions and possible hazards of this work and accepted the conditions to commence the work.
Performing Leader : _____ (name) _____ (signed) _____ (date/time)
Fire Watcher : _____ (name) _____ (signed) _____ (date/time)

I have reviewed all preparations and methods of work and authorized the permit to be issued
Operational Supervisor : _____ (name) _____ (signed) _____ (date/time)

PERMIT EXTENSION

This permit is extended from _____ ((time) until _____ (time) A.P. _____(signed)

from _____ (time) until _____ (time) A.P. _____(signed)

WORK COMPLETION

I have confirmed that the work related to this permit has been completed. Work area has been cleaned and restored, all adjacent areas to which sparks and/or heat might have spread (including floors above and below and opposite side of walls) were inspected for 30 minutes after the work was completed and were found safe.

Performing Person : _____ (name) _____ (signed) _____ (date/time)

Confirmed that the work has been completed and accepted. All safety barriers and signs have been restored.

Authorized Person : _____ (name) _____ (signed) _____ (date/time)

Appendix 6 – Confined Space Entry Permit

CSEP #: - - - - - - -

supreme energy	**CONFINED-SPACE ENTRY PERMIT**

Issue date :			General Work Permit No. #	
Valid from _____ ((time)		Until _____ ((time)		
Description of confined space :				
Reason for entry :				
Atmospheric Testing Certificate	No. #			
Is Hot work allowed?	Yes	No	Hot Work Permit #	

Process Isolations : (/or P&ID as necessary to list all process isolations)

Blind Flanged Installed		Spool Pieces/Valve Removes	

Entry Preparations

Description of hazards	Yes	No	Description of Preparations	Yes	No
Hazardous residue present			Vacating / Draining / Venting		
Physical Stress (Heat/Cold)			Flushing / Purging		
Oxygen Deficiency			Area Barricaded		
Noise			Continuous atmospheric testing and ventilation		
Combustible gas/vapors			Lighting		
Toxic gas/vapors (H_2S)			Life lines		
Chemical contact			First Aider and equipment		
Electrical/Mechanical			Communication Plan Made		

The location where this work is to be done has been prepared for entry, all process isolations are in place, necessary precautions taken, and personnel are aware of their duties, particular hazards and any special precautions and confirm to be safe for entry.
Authorized Person : _____ (name) _____ (signed) _____ (date/time)

I have reviewed and understood all precaution and possible hazards of this work and accepted the condition to commence the work.
Performing Person : _____ (name) _____ (signed) _____ (date/time)

Entry Attendant : _____ (name) _____ (signed) _____ (date/time)

I have reviewed all preparation and method of the work and authorized the permit to be issued
Operational Supervisor : _____ (name) _____ (signed) _____ (date/time)

Permit Extension

This permit extended from _____ (date) _____ (time) Until _____ (time)

Work Completion

I have confirmed that the work related to this permit have completed. Work area has been cleaned, restored and inspected after the work was completed and were found safe

Performing Person : _____ (name) _____ (signed) _____ (date/time)

Confirmed that the have completed and accepted. All safety barriers, signs and process isolations have been restored.
Authorized Person : _____ (name) _____ (signed) _____ (date/time)

I understand the entry conditions and all precautions

ENTRANT NAME	SIGNATURE	DATE	Entry Time	Exit Time

Continue in separate paper

Appendix 7 – Excavation Permit

EP #: - - - - - - -

supreme energy	**EXCAVATION PERMIT**
Issue date :	General Work Permit No. #
Location to be excavated :	
Reason for excavation : …… ……	
I have review the excavation plan and confirm that is safe for excavation work. Electrical Engineer : _____ (name) _____ (sign) _____ (date) Mechanical Engineer : _____ (name) _____ (sign) _____ (date)	
Specific Precaution : …… …… ……	
The area has been reviewed, necessary precautions taken, particular hazards and any special precautions has been addressed. Confirm to be safe for excavation work. Permission is granted. Authorized Person : _____ (name) _____ (signed) _____ (date/time)	
I have reviewed and understood all precaution and possible hazards in the area and accepted the condition. Performing Person : _____ (name) _____ (signed) _____ (date/time)	
I have reviewed all preparation and method of work and authorized the permit to be issued Operational Supervisor : _____ (name) _____ (signed)_____ (date/time)	

Appendix 8 - Change to Existing Work Permit

General Work Permit# _____ **Dated: _____** **Change # _____** **Dated: _____**	
Reason for Change:	
Details of Change	
Addition Precautions	
Change Planned and Checked	Permit Holder
Change Authorized	Operational Supervisor

Appendix 9 – Atmospheric Testing Certificate

ATC #: - - - - - - -

supremeenergy	**ATMOSPHERIC TESTING CERTIFICATE**	
Date :	Time :	
Area/Location :	System :	Equipment :
Reason for testing :		
RESULT		
Oxygen Content : _____ %	Toxic Gas : _____ PPM	Flammable Gas : _____%LEL
(Other) ____ : _____	(Other) ____ : _____	(Other) ____ : _____
Remarks :		
Continuous Atmospheric Monitoring	Yes	No
Re-commended re-testing every : _____ hours / minutes		
Authorized Gas Tester : Name : _____ (Signed) : _____ (Date) : _____ (Time) : _____		

RE-TESTING RESULT

Date	Time	Oxygen	Toxic (. . . .)	%LEL	Other	By (name, signed)	Remarks

Appendix 10 – Electrical Isolation Certificate

EIC #: - - - - - - -

supreme energy	**ELECTRICAL ISOLATION CERTIFICATE**	
Date :		
Area/Location :	System :	Equipment :
Equipment Tag No :		
CB No :		
Reason for Electrical Isolation :		

POWER RE-INSTATEMENT

Confirmed that all related works have been completed, and safe to re-instate the electrical power.

Requested by : _____ (name) _____ (signed) _____ (date) _____ (time)

I have checked the condition and it is safe to re-instate the power for the equipment stated above.
Electrical Power was re-instated by :

_____ (name) _____ (signed) _____ (date) _____ (time)

ELECTRICAL ISOLATION

Please isolate the electric power from the equipment stated above

Requested by : _____ (name) _____ (signed) _____ (date) _____ (time)

Confirmed that electrical isolation has been carried out to the equipment stated above
Electrical Power was isolated by :

_____ (name) _____ (signed) _____ (date) _____ (time)

Chapter 2: Section 19 : Lifting and Lifting Equipment

Content

19. Lifting and Lifting Equipment

19.1 Introduction

This section describes SUPREME ENERGY (the Company) Safety guidance for all those personnel having responsibility for safety in the selection and use of lifting plant and equipment.

Various types of lifting equipment are used within the Company for lifting and moving the materials critical for conducting our day-to-day activities. In order to maintain a high level of safety where lifting equipment are used, a comprehensive process is necessary for managing their operation, including training and qualifying operators, preventive maintenance and inspections.

This document provides guidance for instituting such a system. It identifies management, supervisor and employee responsibilities and provides information for determining the appropriate qualifications for lifting equipment operators. It also provides important information for planning non-routine lifts. Additionally, this guideline includes basic safe operating practices, and inspection and maintenance requirements. Lastly, information is provided to facilitate the selection, use, inspection, and storage of rigging equipment.

It is not possible in a document of this nature to cover every lifting application in detail. However, it is anticipated that most problems can be settled by reference to the principles contained within this document.

19.2 General Lifting

19.2.1 Definitions

Lifting Appliance
Any machine other than a crane used to raise or lower a load, but does not include a conveyor, elevator or an excavator handling soil, aggregate, mineral or a like substance.

Load Indicating Device
A device that measures and displays the weight of load being lifted or force being applied.

Minimum Breaking Load (MBL)
The maximum certified test load that the rope will carry without parting.

Qualified Person
A person who, by possession of a recognised degree, certificate or professional standing, or who by knowledge, training or experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the subject.

Safe Working Load (SWL)
The maximum rated load which can be safely handled by a machine under specified conditions.

19.2.2 Lifting

- All personnel involved in lifting of any kind shall have the required skill, knowledge, experience and qualifications for the task being performed.
- Before starting any lift, the weight to be lifted, together with the lifting tackle to be used shall be determined.
- Lifting areas must be properly lit for safe handling of the load.
- Unless unavoidable, personnel shall never walk or stand under suspended loads and, as far as possible, all personnel shall keep clear of the area of operations.
- Particular care shall be used in moving or lifting heavy equipment especially around pressure vessels, lines, and wells. It may be necessary, or required, to shut in or bypass a system where such lifts are made.
- Chains are not allowed for lifting activities, except for chain hoist / chain block use. Refer to *19.8 Chain Hoist*.

19.2.3 Use of Lifting Equipment

- No lifting gear is to be used unless it is certified to be safe by an appropriate Indonesian authority.
- New or serviced items shall not be used unless a test certificate has been received.
- Lifting equipment out of its statutory life is not to be used.
- No lifting equipment is ever to be loaded above its SWL, except for the purpose of proof testing.
- If a lifting appliance is fitted with a SWL indicator, or alarm, this shall not be disconnected at any time while the equipment is in service.

- All items of lifting equipment shall be clearly marked (die stamped if possible) with its SWL and identification number.
- Those parts of lifting appliance wire-lines which are liable to suffer wear or deterioration are to be examined at intervals of 7 days.
- When lifting gear is damaged or worn beyond repair, it shall be destroyed in such a fashion as to be rendered useless. Records shall be adjusted and the test certificate cancelled.

19.2.4 Examination and Testing of Lifting Equipment

- All lifting gear and appliances shall be examined and tested to the requirements of the relevant statutory legislation.
- Details of all examinations and tests are to be recorded in the official register and be available, along with test certificates, for inspection.

19.3 Cranes

19.3.1 Definitions

Crane
Any appliance equipped with mechanical, hydraulic, pneumatic or electrical means for raising and lowering a load by ropes or slings and transporting the load while suspended. It includes all ropes, slings, shackles, swivels, rings, hooks, or other tackle used in the operation of a crane but does not include:

- a hoist block running on a fixed rail or wire
- a stacker or conveyor whereby a load is moved by means of a belt or platform
- an earth moving or mineral moving or excavating appliance not fitted with a grab.

Crane Operator
A person who through training and experience is assessed as competent to operate a particular make and model of crane and holds a valid certificate.

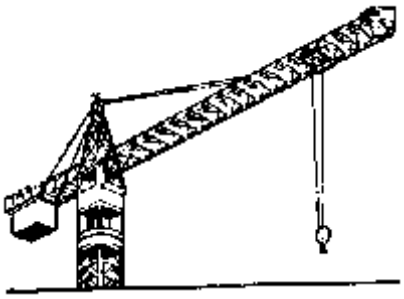
Dogman/Pilot
A person who through training and experience is qualified to sling loads and direct the lifting and placing operations of a crane.

Safety Ropes or Boom Arresters
Ties fitted between the underside of the boom to a fixed part of the crane to prevent whip back. Safety ropes may also be fitted between the underside of a fly jib and boom.

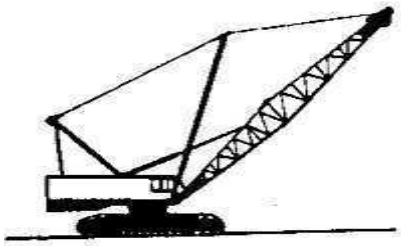
19.3.2 Crane Operation

- All cranes shall be operated by a trained and certified operator. They shall be operated within the scope of their rating, and shall be maintained in good order and condition at all times.
- Before any crane is used, it shall have a valid test certificate or be in date for test.
- Immediately before being put into use after installation, re-installation, substantial alterations or repair, or at maximum intervals of 1 year, the crane must be re-tested. The person shall not be an employee of the company.
- A check is to be completed at the commencement of each shift. The check is to cover cables, fittings, drums, dog brakes, boom, hooks and guards. Limit switches are to be tested to ensure that they are working correctly. Sheaves and other rotating parts are to be greased on a regular basis as recommended by the manufacturer.
- Crane safety load indicators and alarms shall be inspected and tested at intervals of seven days.
- A table showing the SWL and radius limitations of the crane shall be prominently displayed in the crane cabin. The table shall take into account the number of lines that are being used with regard to concluding the SWL. For any change of boom length the table shall be changed to clearly show the new SWL and radius limitations.
- The crane operator shall be advised of the weight of each load to be lifted.
- The crane boom and hook shall be safely secured before the operator leaves the crane.
- Cables on the drum are never to be run off to less than two remaining turns.
- Crane activities shall stop in the event of a potentially dangerous situation.
- Crane hoisting mechanisms shall never be used for any purpose other than lifting or lowering.

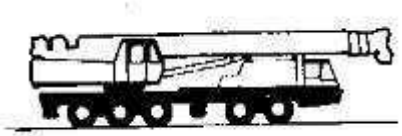
- No crane operation will take place without an appointed 'dogman', and an adequate system of communication between the 'dogman' and the crane operator being established (see the hand signals shown in section 19.3.7).



Tower Crane

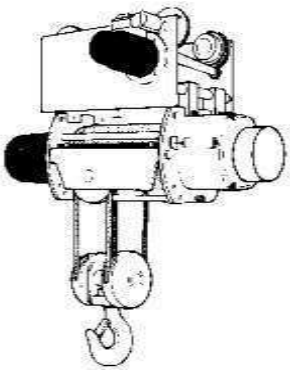


Track Crane



Mobile Crane

All Terrain Crane



Gantry Crane

Figure 19.1: Types of Crane

19.3.3 Training and Qualification for Crane Driving

- No person under the age of 18 years shall drive or operate a crane.
- Cranes are only to be operated by persons who have been trained and qualified to an appropriate level.
- Only personnel with good sight (corrected with spectacles if necessary) and good hearing are to be selected as crane drivers.

19.3.4 Operator's Responsibilities

Teamwork in cranage is essential. In order to achieve this, there must be on-going communication between all involved in crane operations. Operators shall:

- operate the machine safely
- operate the crane or lifting appliance in accordance with the manufacturer's instructions and within its safe working load (SWL)
- not interfere with or disconnect any limiting or safety device intended for the safe operation of the crane or lifting appliance
- not continue to lift a load which causes the safe load indicators to alarm
- report any defect in their crane or lifting appliance to their supervisor
- carry out each lift in a safe and efficient manner
- beware of hazards in the vicinity of the lifting operation.

19.3.5 Loads

- Whenever loads are being handled, the operator shall be alert to the potential hazards involved. Some of the more obvious points that operators must take into consideration, include:
  - crane or lifting appliance capacity rating, at required position
  - the weight of each load to be handled
  - the safe working load of any rope, sling or shackle used.
- All loads shall be secured to prevent slipping or displacement. The security of each load shall be checked after it has been raised a few centimetres.
- Loads shall never be left suspended if the crane is unattended.

19.3.6 Safety Devices

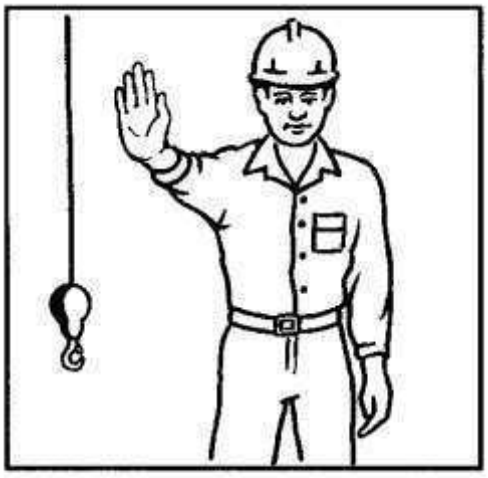
All safety devices provided on cranes which indicate an unsafe or an overload condition shall be kept in first-class working order and shall be tested at least once a week. The adjustments are to be in the right range and the device in good working order. These tests are to be recorded.

19.3.7 Signalling

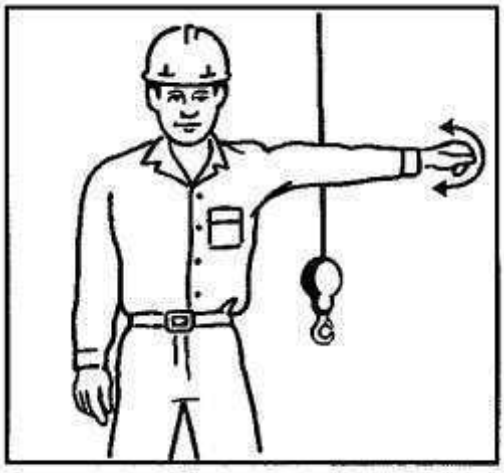
Signalling to operators shall be done in accordance with recognised standards, and then only by persons who have the required knowledge and experience and are fully conversant with the operation.

- The signaller shall stand in a secure position where they can see the load and can be clearly seen by the driver.
- The signaller shall face the driver if possible.
- Each signal shall be distinct and clear.

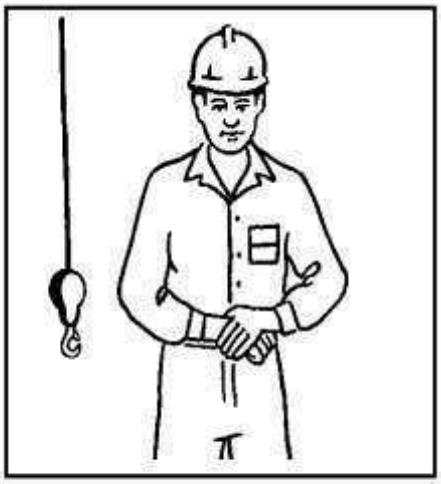
Illustrations that show recommended crane signals are included on the following pages.



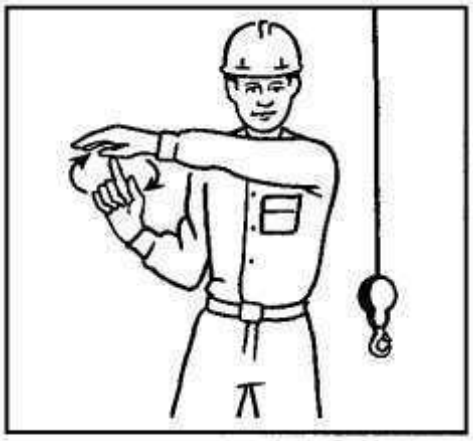
STOP A. Extend one arm forward. EMERGENCY STOP is indicated by extending both arms.



STOP B. Arm extended, palm down, move hand right and left. Usually for tower crane operation.

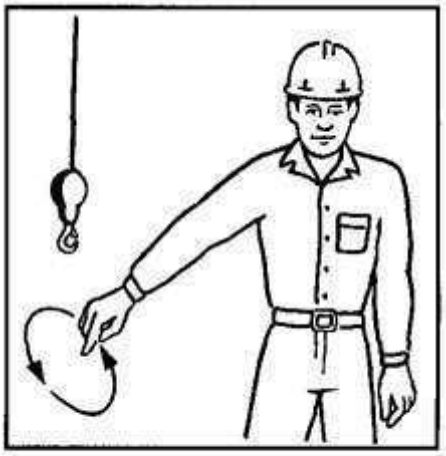


HOLD EVERYTHING. Clasp hands in front of body.

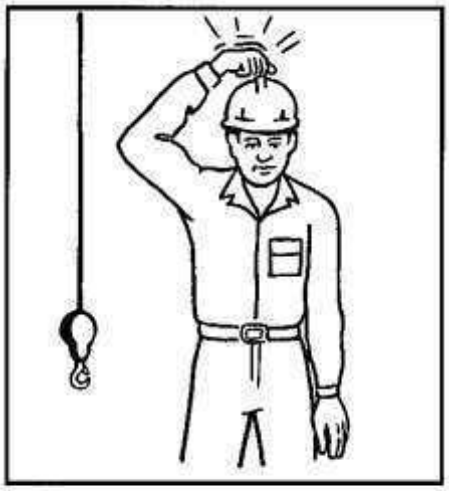


MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (HOIST SLOWLY shown as example.)

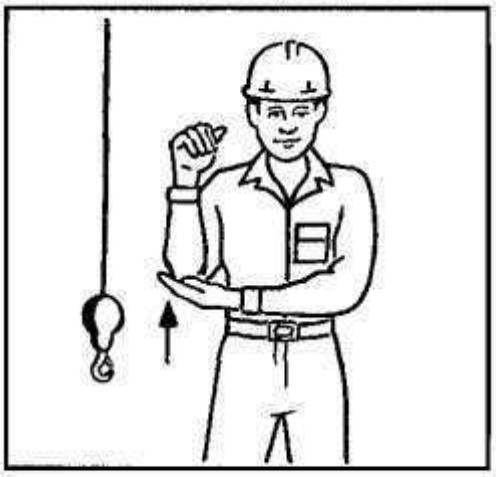
HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circles.



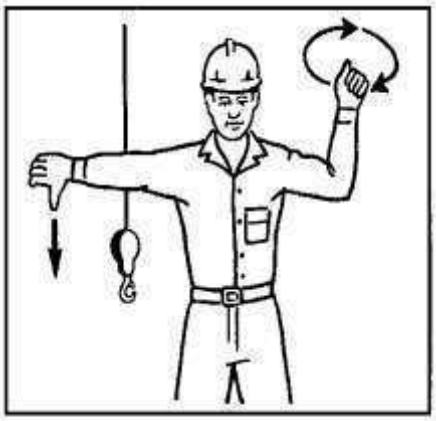
LOWER. With arm extended downward, forefinger pointing down, move arm in horizontal circles.



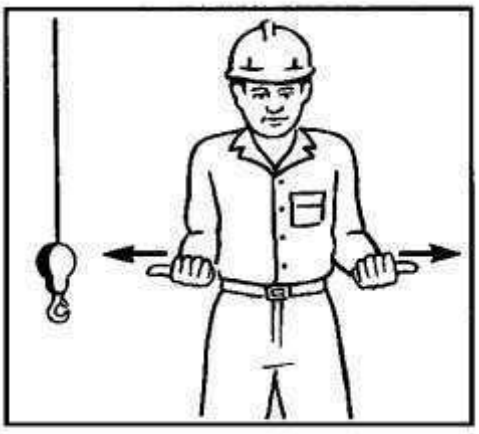
USE MAIN HOIST. Tap fist on head, then use regular signals.



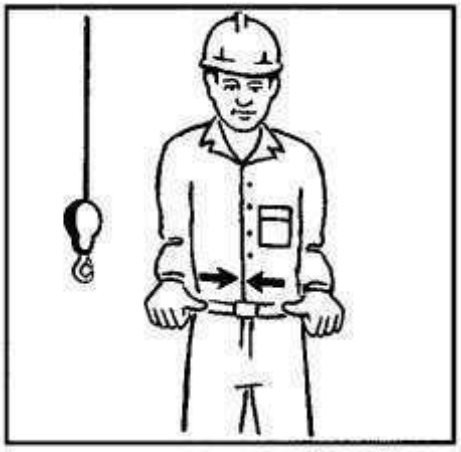
USE FLYLINE (auxiliary hoist). Tap elbow with one hand, then use regular signals.



LOWER THE BOOM AND RAISE THE LOAD. Right arm extended, thumb pointing down and left forearm and forefinger vertical, move left hand in small horizontal circles.

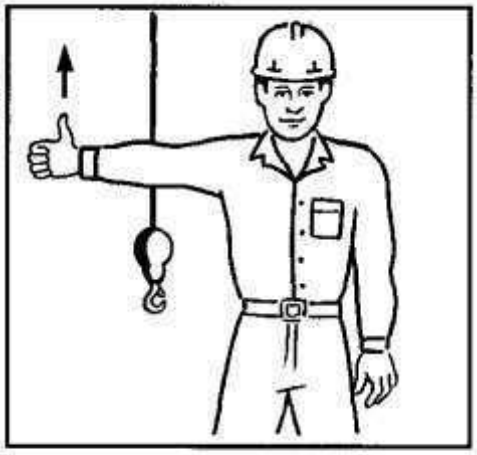


TROLLEY OUT or EXTEND BOOM. Both fists in front of body with thumbs pointing outward.

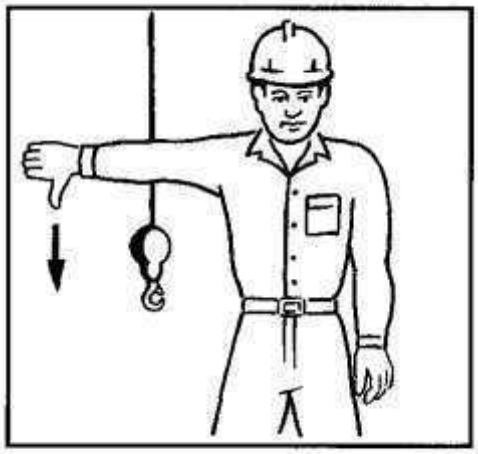


TROLLEY IN or RETRACT BOOM. Both fists in front of body with thumbs pointing toward each other.

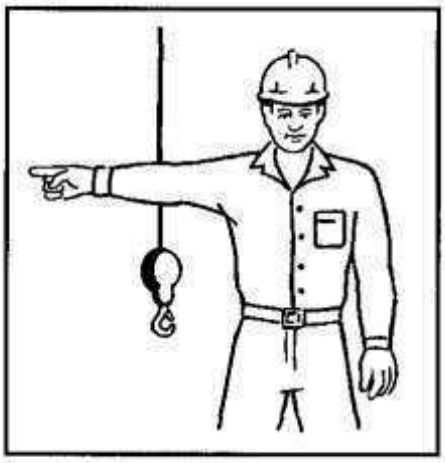
TRAVEL. Arms each bent at elbows, fists clenched, rotate both forearms around each other. Then point in the direction of travel.



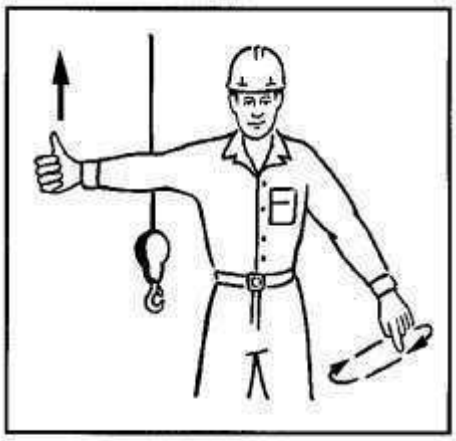
RAISE BOOM (luff up). Arm extended, fingers closed, thumb pointing upward.



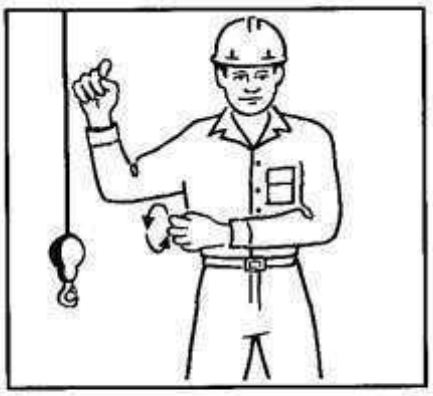
LOWER BOOM (luff down). Arm extended, fingers closed, thumb pointing downward.



SLEW. Arm extended, point with finger in direction of swing of boom.



RAISE THE BOOM AND LOWER THE LOAD. Right arm extended, thumb pointing up, left arm extended downward swinging in horizontal circles.



TRAVEL (one track). Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist rotated vertically in front of body. (For crawler cranes only.)

FINISHED WITH CRANE. Place arms above head and cross arms.

19.3.8 Mobile Cranes

- A 'mobile crane plan' shall be completed prior to using a mobile crane at the site.
- Where outriggers are fitted to wheels of cranes, they shall be fully extended and firmly jacked before lifting operations commence.

- Only cranes specifically designed for the purpose shall be used to transport loads. The hoisting mechanism of a crane shall not be used for any other purpose than lifting or lowering the load vertically.
- Hooks shall be properly and safely secured while the crane is in transit, with the jib in the 'shut-down' position.

19.3.9 Gantry Cranes

- Warning notices shall be posted in prominent positions, especially at access points, to indicate that a crane operates in the area.
- An audible warning device must operate whenever a gantry crane is in use or tracking.
- No work may be carried out on or near the crane tracks or in way of the crane's travel, until the crane has been rendered inoperable by electrical isolation.

19.3.10 Multi-Lifting

Multi-lifting is a hazardous operation that requires close team work between operators, dogman, and machines.

The following rules must be observed:

- A detailed work method statement is to be prepared and checked before the work is carried out. This statement should include the duties and responsibilities of all personnel involved and the safe practices to be followed.
- Operators and dogman shall be experienced, not trainees unless under the direct supervision of an experienced person.
- The multi-lift is to be under the direction of one experienced person.
- Directions between dogman and operators may be direct line of sight using signals (set out above) or by two-way radio or telephone with a dedicated channel.
- It is recommended that the crane safe working load (SWL) ratings be reduced by 25% on each crane.
- The weight of the lift shall be made known to all involved.

- Where cranes are used to lift a load beyond their individual capacity, the load should be distributed between each crane - equalising tackle.
- Each crane shall be set up level and stable.
- Throughout the lifting operation, the hoisting ropes shall be vertical.
- Where practicable, a trial lift shall be made.
- All lifting equipment shall be certified, checked and any faulty equipment discarded from use.

NOTE: While it is accepted that there are some lifts that can only be carried out using more than one crane, it is not a work practice that is recommended.

19.3.11 Snagged or Stuck Loads

Any load that may overload a crane even though the weight is less than its SWL, due to vacuum or bonding between load and/or support should be wedged or levered free. Never try to free a snagged or stuck load by slewing line. Beware of exceeding the safe working load (SWL) when trying to free a stuck load.

19.3.12 Tag Lines

Where there is a likelihood of load-spin, tag lines should be attached and used (see Figure 19.19).

19.3.13 Wind Conditions

Consideration needs to be given to wind speed prior to undertaking any lift. Loads with large surface areas can be hazardous, as the wind may cause the load to spin, resulting in loss of control.

19.3.14 Crane-Lifted Work Platforms

The use of a crane to suspend a working platform is restricted to work that cannot reasonably be carried out safely by other means. Conditions that apply to the use of a crane-suspended working platform are listed below:

- The working platform shall be certified as safe by an appropriately qualified person.
- The occupied platform shall be raised and lowered under power. Free fall is not permitted.

- The crane operator shall have had at least 80 hours safe operating experience on the machine being used.
- The operator shall remain at the controls at all times when the platform is in use.
- The perimeter of the work platform shall be fitted with sides or guard rails, mid-rail and toe boards.
- The platform's weight and safe working load shall be clearly displayed on the platform and not exceeded.
- All shackles shall be moussed and the hook shall have a safety latch.
- Personnel working from the platform shall wear a safety harness attached to a suitable independent point and/or line.

19.3.15 Crane-Hoisted Personnel Baskets

Personnel working in or working from personnel baskets shall wear a safety harness and have their lanyards secured while aloft. Refer to Section…: *Working at Height*.

The use of a crane to suspend a personnel basket is restricted to work that cannot be carried out safely by other means.

19.4 Rigging

19.4.1 Rigging of Loads

- All slinging of loads shall be done by experienced personnel and care must be taken in assessing the correct weight, the load, and the correct size of slings required.
- All ropes, slings and lifting tackle shall be free of any obvious defects, shall be of adequate strength, shall be constructed of sound material, and shall be maintained in good order and condition.
- Slings and lifting tackle shall be examined as required by the manufacturer’s instructions and records kept of all examinations.
- Any defective items shall be removed from use.

19.4.2 Factor of Safety

This is the ratio of the load that would cause failure of a member or structure to the load that is imposed upon it in service. Unless otherwise prescribed, the factor of safety should be a minimum of 3.

Table 19.1: Lifting Equipment Factors of Safety

Lifting Equipment	Required Factor of Safety
Wire Rope	5
Hand Haulage Fibre rope	6
Electric and air operated hoists	10
Webbing Slings	6
Shackles	4

19.4.3 Safe Working Load (SWL)

This is the maximum load calculated in accordance with sound and accepted engineering practice taking account of the appropriate safety factors identified in Section 19.4.2, that can be supported safely under normal working conditions.

- The safe working load (SWL) of each sling shall be clearly identified by user.
- The SWL must not be exceeded.
- Slings should always be used as near vertical as possible.

On two leg slings, always be aware of the changing SWL factor with changing angles of the sling. In general if L is greater than S, as shown in Figure 19.3, then slinging is acceptable. Refer to Section 19.4.5 for more details on slinging methods and sling angles.

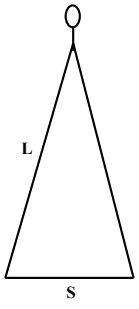


Figure 19.2: Sling Ratio

19.4.4 Safe Use of Slings

The basic objective of good slinging practice is to ensure that the load is safe and, when slung, is as secure in the air as it was on the ground. The basic principles are listed below:

- The sling and its method of use shall be suitable for the load.
- The method of attachment of the sling to the load and the sling to the lifting appliance shall be secure.
- No part of the sling shall be overloaded either by the weight of the load or the method of slinging
- The slinging method shall ensure that the load is secure and the load will not fall from the sling
- The load shall be balanced and stable so that it cannot violently change its attitude when lifted.
- The load shall not be damaged by, or cause damage to, the sling.

19.4.5 Methods of Slinging

Slings can be used in a variety of ways according to the requirements of the job. The lifting capacity or sling safe working load (SWL) required, is calculated by:

- determining the weight of the load to be lifted
- determining the slinging method ensuring that restrictions of the sling-load connection / attachment method (Section 19.4.6) are met
- adjusting the SWL of the slings for the chosen slinging method as per this section
- adjusting the required sling SWL by the sling-load connection/attachment rating (column 3 of Table 19.2) by multiplying the sling SWL by the rating of the chosen attachment method.

19.4.5.1 Two-Leg Sling

A two-leg sling comprises of two legs permanently connected at their upper ends by a suitable ring or link and marked as an assembly. Two-leg slings may be used to handle a wide range of loads. (See figure 19.3)

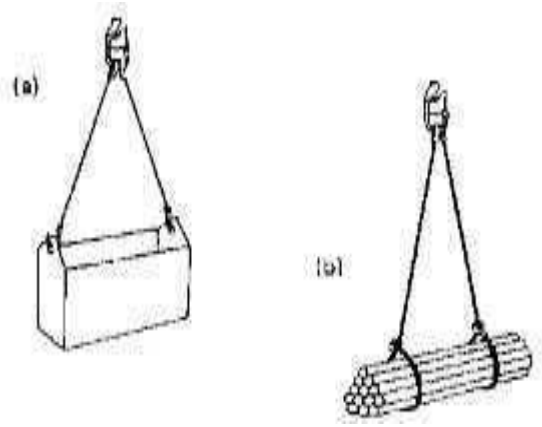


Figure 19.3: Two-Leg Slings

Where the included angle between legs is from 0^{o} to 90^{o}, or each sling leg is not more than 45^{o} to the vertical, the safe load limit of the two leg sling assembly is calculated by multiplying the SWL of one sling leg by 1.4, i.e. SWL x 1.4 = safe load limit of the two leg sling assembly.

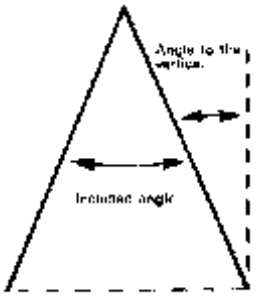


Figure 19.4: Diagram Showing Restriction Angles for Two Leg Slings

19.4.5.2 Three-Leg Sling

A three-leg sling comprises three legs permanently connected at their upper ends by a suitable ring or link assembly and marked as an assembly. Three-leg slings are commonly used to handle circular or irregularly shaped loads where the legs can be equally spaced. (See figure 19.5)

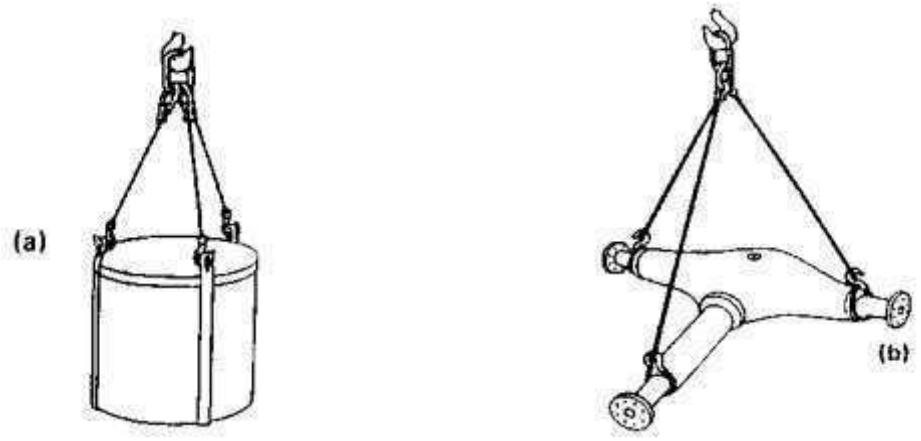


Figure 19.5: Three-Leg Slings

Where the maximum included angle between any leg and vertical is not greater than 45°, the safe load limit of the three leg sling assembly is calculated by multiplying, the SWL of one leg by 2.1, i.e. SWL x 2.1 = safe load limit of the three leg sling assembly.

Where the maximum included angle between any leg and vertical is greater than 45°, but not more than 60°, the safe load limit of the three leg sling assembly is the SWL of one leg multiplied by 1.5, i.e. SWL x 1.5 = safe load limit of the three leg sling assembly.

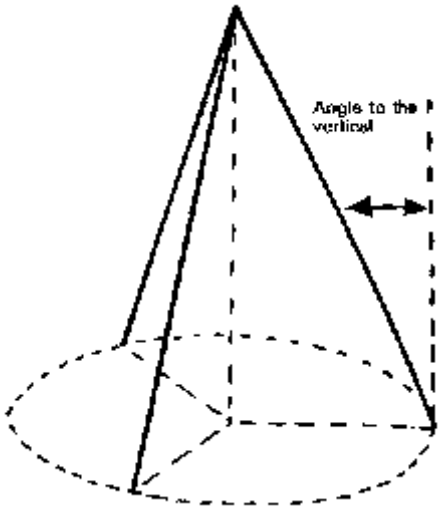


Figure 19.6: Diagram Showing Restriction Angles for Three Leg Slings

19.4.5.3 Four-Leg Sling

A four-leg sling comprises four legs permanently connected at their upper ends by a suitable ring or link assembly and marked as an assembly. Four-leg slings are mainly used to handle square or rectangular (four cornered) loads. (See Figure 19.7).

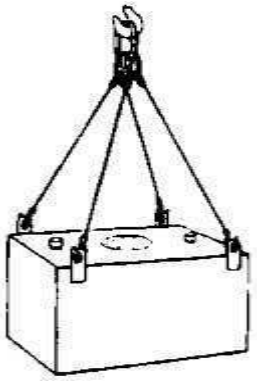


Figure 19.7: Four-Leg Sling

Where the maximum included angle between either set of two diagonally opposite legs is not greater than 90^{o} or the maximum angle between any one leg is not greater than 45^{o} to vertical, the safe load limit of the four leg sling assembly is the SWL of one leg multiplied by 2.1, i.e. SWL x 2.1 = safe load limit of the four leg sling assembly.

Where the maximum included angle between either set of two diagonally opposite legs is between 90^{o} and 120^{o}, the safe load limit is the SWL of the four leg sling assembly of one leg multiplied by 1.5, i.e. SWL x 1.5 = safe load limit of the four leg sling assembly.

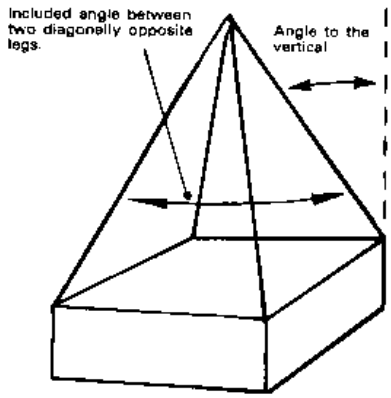


Figure 19.8 : Diagram Showing Restriction Angles for Four Leg Slings

19.4.6 Methods of Sling Attachment

19.4.6.1 Endless Slings

Endless slings are generally used in a choke hitch (see figure 19.9) and may need derating as recommended by relevant standards or the manufacturer or supplier. (Also, refer to Table 19.2: Sling Load Connection/Attachment Rating Chart.)

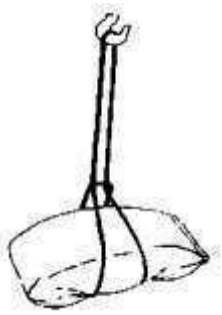


Figure 19.9 Endless sling

19.4.6.2 Straight-Leg Slings

A single or multi-leg sling may be used with the legs straight if, for example, the legs are terminated in hooks which can be attached directly to a suitable lifting point on the load.

19.4.6.3 Choke Hitch

Single-leg or multi-leg slings may both be used in choke hitches. The basic advantages of a choke hitch are firstly that a sling may be attached to a load which has no suitable lug or eye bolt etc. and secondly, that the sling tends to bind the load together.

A choke hitch using a hook is sometimes known as ‘snickling’.

In forming a choke hitch, the sling is bent round a small diameter which may be the eye of the sling itself or the saddle of a hook or other fitting. In these circumstances, the load in the sling will be increased at the point of choke and for this reason some derating may be necessary in order to prevent the sling being locally overloaded. For instance, for fibre rope slings and webbing the safe working load should be reduced to 0.8 of the safe working load of the straight leg (refer to Table 19.2: Rating Chart).

19.4.6.4 Double-Wrap Choke Hitch

A double-wrap choke hitch is a variation on a choke hitch where the sling is passed one complete turn around the load before being choked. This increases the binding effect and should be used on loose loads such as bundles of tubes.

The sling shall be derated by the same amount as for an ordinary choke hitch.

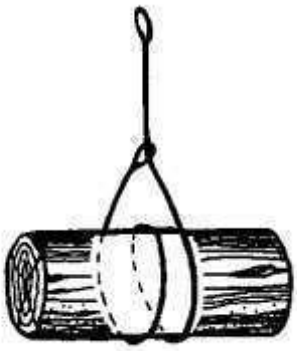
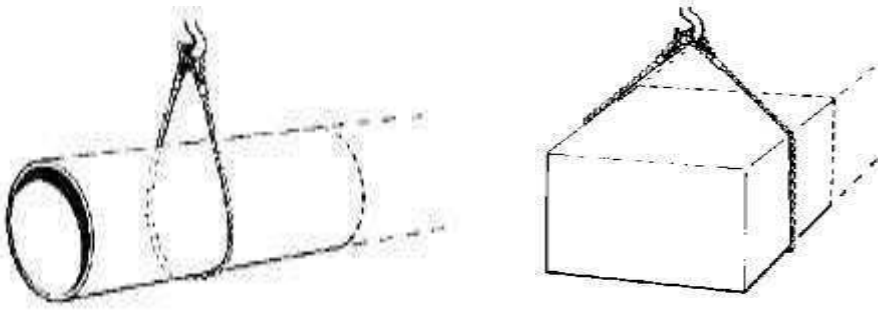


Figure 19.10: Double-Wrap Choke Hitch

19.4.6.5 Basket Hitch

The basket hitch is normally used with slings in pairs for handling loads such as a large roller but it is not suitable for cradling loose bundles. If only one sling is used, the sling shall be passed through the load at a point above the centre of gravity to ensure it is safely secured.



The use of two hooks is necessary for stability of basket hitches

Figure 19.11: Basket Hitch

If a sling in basket hitch is used with both legs parallel, i.e. with an included angle of 0^{o} between the legs of the basket, then twice the safe working load of the sling may be lifted.

With the terminations of both ends of the sling on the hook the load lifted may be increased to not more than 1.5 times the safe working load of the sling provided the included angle does not exceed 90^{o}.

If two slings are used in basket hitch in the same manner the load may be increased to 2.0 times the safe working load of the sling, again provided that no included angle between adjacent or diagonally opposite legs exceed 90^{o}. The above factors for basket hitches assume that all sharp edges are adequately packed.

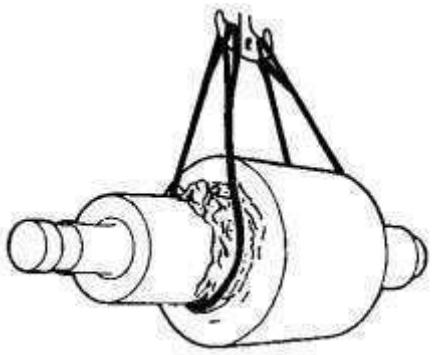


Figure 19.12: Two Sling Basket Hitch

19.4.6.6 Double-Wrap Basket Hitch

In double-wrap basket hitch the sling is passed completely around the load. This will help to ensure the security of loose bundles. If security of the load is the prime consideration, then a double-wrap choke hitch is recommended. The factors are the same as for a basket hitch.

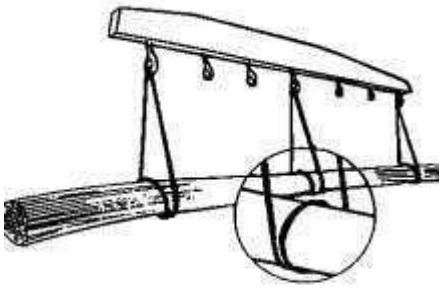


Figure 19.13: Double -Wrap Basket Hitch

19.4.6.7 Double and Choke Hitch

The double and choke hitch is a variation of a choke hitch where the load is carried on two parts and for this reason the safe working load in the choke hitch may be varied in accordance with the manufacturer's or supplier's advice.

Where this is not available, the single choke hitch rating shall be used. This is sometimes known as 'halshing'.

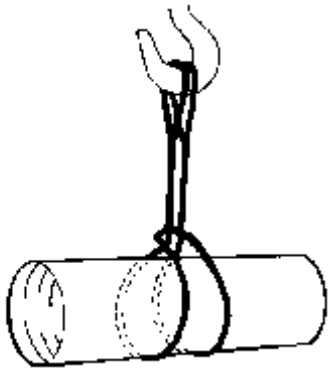


Figure 19.14: Double and Choke Hitch

Table 19.2: Sling-Load Connection / Attachment Rating Chart

This table shall be used in conjunction with the slinging method rating requirements outlined in Section 19.4.5.

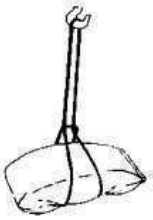
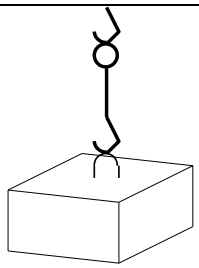
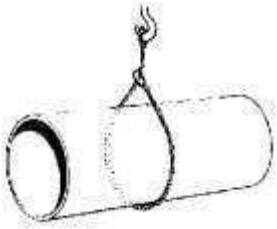
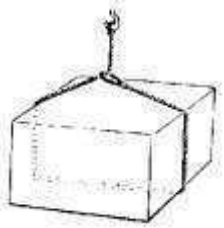
Diagram of Slinging Method	Connection/Attachment method	Rating
	*Endless Sling*	0.80
	*Straight Leg Sling*	1.00
	*Choke Hitch* Included angle $\leq 120^{o}$	0.75
	*Choke Hitch* Included angle $\geq 120^{o}$	0.50
	*Choke Hitch* 2 slings, included angle of any 2 legs $\leq 90^{o}$ - round 2 slings, included angle of any 2 legs $\leq 90^{o}$ - square	1.00 0.66

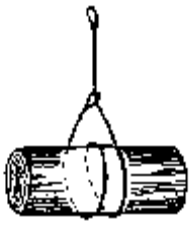
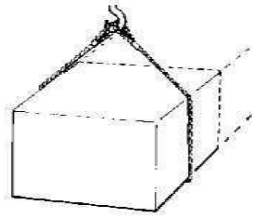
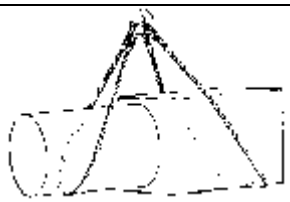
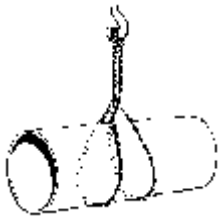
Diagram of Slinging Method	Connection/Attachment method	Rating
	*Double Wrap Choke Hitch* Included angle $\leq 120^{o}$ Included angle $\geq 120^{o}$ 2 slings, included angle of any 2 legs $\leq 90^{o}$ - round 2 slings, included angle of any 2 legs $\leq 90^{o}$ - square	0.75 0.50 1.00 0.66
	*Basket Hitch* Included angle = 0^{0}	2.00
	Basket Hitch Included angle $\leq 90^{o}$	1.50
	*Basket Hitch* Included angle $\geq 90^{o}$	1.00
	*Basket Hitch* 2 slings, included angle of any 2 legs $\leq 90^{o}$ - round 2 slings, included angle of any 2 legs $\leq 90^{o}$ - square	2.00 1.33
	*Double Wrap Basket Hitch* Included angle = 0^{o} Included angle $\leq 90^{o}$ Included angle $\geq 90^{o}$ 2 slings, included angle of any 2 legs $\leq 90^{o}$ - round 2 slings, included angle of any 2 legs $\leq 90^{o}$ – square	2.00 1.50 1.00 2.00 1.33
	*Double and Choke Hitch* Included angle $\leq 120^{o}$	1.50

Diagram of Slinging Method	Connection/Attachment method	Rating
	*Double and Choke Hitch* Included angle $\geq 120^{o}$	1.00
	*Double and Choke Hitch* 2 slings, included angle of any 2 legs $\leq 90^{o}$ - round 2 slings, included angle of any 2 legs $\leq 90^{o}$ - square	2.00 1.33

19.4.7 Some Essential Precautions

19.4.7.1 Before Lifting the Load

- The weight of the load shall be ascertained before lifting and the lifting material shall be suitable for the load.
- The sling shall be strong enough for the load, both in terms of its safe working load and its actual condition. The sling shall be carefully inspected for obvious defects before use.
- The load shall be secure, stable and balanced when lifted so an assessment of the position of its centre of gravity is necessary to ensure that the lifting point is approximately over it.
- Failure to ascertain the centre of gravity is likely to cause the load to swing wildly on being lifted, or even to fall out of the sling.
- Any loose parts of the load shall be adequately secured either by the lifting method or by other means.

19.4.7.2 When Fitting the Sling to the Load

- The sling must be firmly secured to the load, e.g. by means of hooks on to purpose designed lifting points, eye bolts, etc. or by a suitable method of slinging. The sling must not be twisted, knotted or kinked in any way, nor shall the lifting points be overloaded by the slinging method.

- The rated included angle (90^o or 120^o) must not be exceeded and the angle at any choke shall not exceed 120^o or at any basket shall not exceed 90^o.

19.4.7.3 On raising or lowering the Load

- A recognised code of signals shall be used between the slinger and the crane driver (see section 19.3.7). Ensure that the load is free to be lifted, e.g. all holding down bolts and/or dowels have been released.

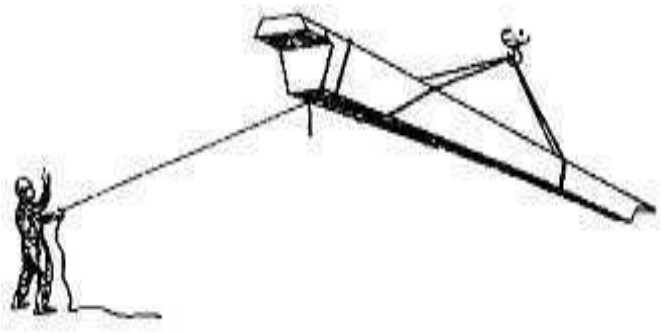


Figure 19.15: Taglines

- A suitable setting down area shall be selected before lifting. Make sure that the load is placed on battens, etc. so that the slings can be easily withdrawn.
- Having set the load down correctly, the empty sling legs shall be manually withdrawn by the slinger and hooked back on to the crane hook or upper terminal fitting to prevent accidental 'hook-up' of surrounding objects or the striking of an individual.

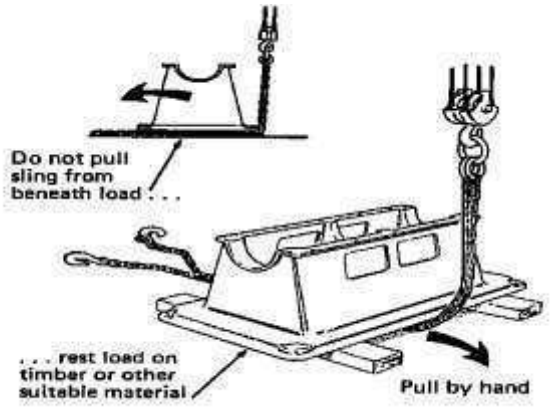


Figure 19.16: Place, Load on Battens

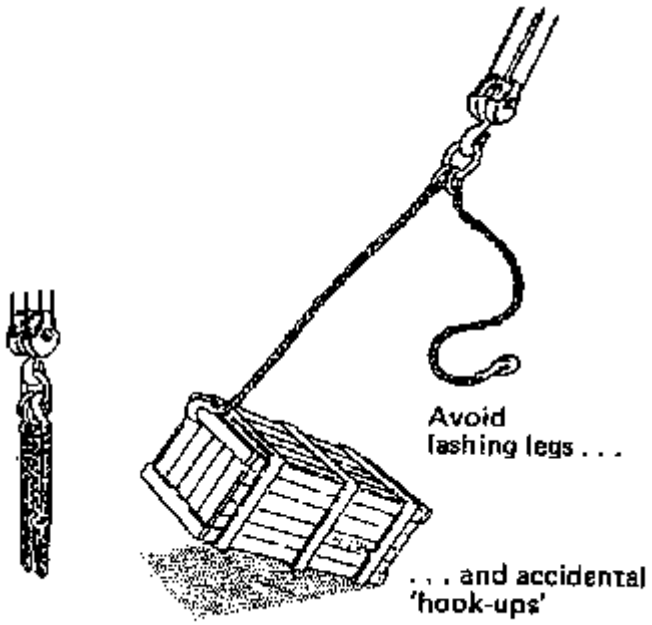


Figure 19.17: Tying of Sling Legs

19.4.7.4 Packing

Care must be taken, by the use of wood or other similar material, when slinging a load, to ensure that the sling is not bent over a small curvature or sharp edge, since this may damage the slinging. It is important also not to damage the loads. The objects of packing are:

- to provide an adequate radius around which a sling may pass without unacceptable loss of load carrying capacity
- to assist the sling in gripping the load
- to prevent damage to the load itself.

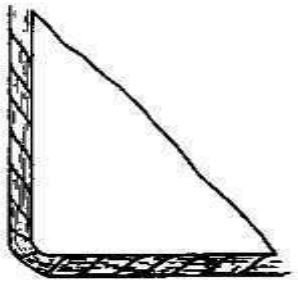


Figure 19.18: Wire Rope Kinked

Various materials are suitable for packing. Whatever is used must be capable of taking the crushing forces which will be imposed upon it, and it should be positioned to make best use of its strength (as is shown in Figure 19.19).

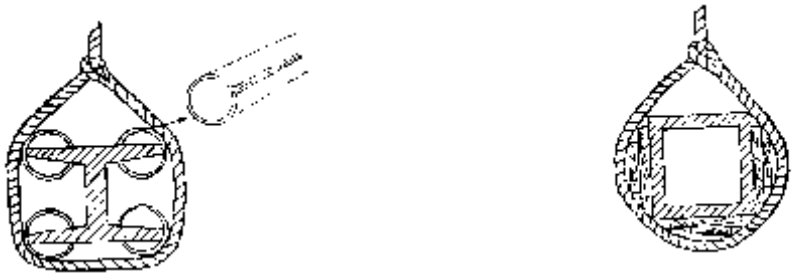


Figure 19.19: Good Packing

Example of bad packing is shown below in Figure 19.20. It shows timber packing at the corners which would almost certainly split under load and the load fall out.

Figure 19.20: Bad Packing Practice

19.4.8 Inspection

Inspection requirements for rigging equipment are listed in Table 19.3 below.

Table 19.3: Inspection of Rigging Equipment

Items	When Testing is Required	Thorough Examination
Rings Hooks Shackles Swivels Similar items (e.g. eye bolts, turn buckles.)	Before taking into use and after repair	After proof testing and at least every six months
Wire ropes Wire rope slings	Before taking into use, a sample of the rope tackle should be tested to destruction and the breaking load recorded	After proof testing and at least every six months
Fibre ropes Fibre rope slings All textile based slings Round slings, etc.	Before taking into use, a sample of the material and/or sling should be tested to destruction and the breaking load recorded	At least every six months
All lifting machines and similar items (e.g. runways, jacks, beams, etc.)	Before taking into use and after repair	After proof testing and at least every twelve months

19.4.9 Personnel Lifts / Hoisting Devices and Aerial Lifts

The devices covered by this section include non-lift suspended snorkel, scissors lifts, cherry pickers etc.

Personnel working in, or working from these lifts must wear a safety harness with a lanyard and secure their safety lanyard to the lift basket at all times (see Section …: *Working at Height*).

- Never exceed the SWL of the machine to prevent the machine overturning or overstressing the machine's components.

- Never position the machine over persons, or allow employees to go under the working platform, unless it is essential to the operation, and on these occasions take extra safety precautions.
- The platform shall not be used as a prop, tie or crane.
- Never move the platform closer than 4m to overhead electric lines unless permitted writing by the Electrical Supervisor.

19.4.10 Wire Rope Grips

- Wire rope grips shall be correctly applied in order that the stresses within the terminal are evenly distributed.
- Always fit the grips the same way round, with the bridge on the loaded or long part of the rope and the U-bolt on the short part.
- On any wire rope a minimum of three grips must be used and spaced at a centre to centre grip distance of six rope diameters. The numbers of wire rope grips required are:
  - up to and including 19mm (3/4 in.) rope: three grips
  - over 19mm and up to and including 32mm rope: four grips
  - over 32mm and up to and including 38mm rope: five grips
  - over 38mm and up to and including 44mm rope: six grips
  - over 44mm and up to and including 56mm rope: seven grips

19.4.11 Ropes / Slings

Combination ropes, i.e. wire ropes with a fibre covering, are not to be used as lifting gear.

19.4.11.1 Wire Ropes / Slings

- Flexible wire ropes or slings shall not be used if any broken wires are visible.
- Wire slings shall not be shortened by knotting.

Note: Docks' splice - sometimes known as a five-tuck splice, is a splice in a wire rope which has at least three tucks with a whole strand of the rope and two tucks with one half of the wires cut out of each strand. The strands in all cases are tucked against the lay of the rope. In all other cases, e.g. a compressed (swagged) ferrule, proof load testing is necessary to prove the effectiveness of the termination.

19.4.11.2 Fibre Ropes / Slings

- When joining fibre ropes, always use a double sheet bend. Never use a reef knot to join ropes.
- Fibre ropes must be hung up in a free circulation of cool air when not in use. Their exposure to oils, acid, or other chemicals shall be avoided.
- Fibre rope slings shall not be used for any duty if the rope is badly chafed externally, or worn internally, or where the fibres have noticeably deteriorated to a marked degree. Ropes in this unsafe condition are to be destroyed.

19.4.12 Shackles.

- Ordinary bolts shall not be used as shackle pins.
- Hooks that anchor ropes or pulleys on suspended scaffolds/loads shall be moused to prevent accidental unhooking.
- Shackles used in scaffolding / loads shall have their SWL clearly marked and when in use the pin shall be securely screwed in and moused to the Dee-rings.
- When using a shackle to form a running noose always fit the back of the Dee-rings to the standing or running part of the rope.

19.4.13 Eye bolts

Eye bolts shall be marked with the SWL, and, unless also marked to the contrary, or fitted with an integral link, the load shall not be applied other than longitudinally. If marked otherwise or fitted with an integral link the load is not to be applied in excess of 45^{o} from the longitudinal.

An eye bolt used for lifting shall have a screwed shank of at least $1^{1}/_{3}$ times the diameter. Both the male and female threaded portions shall be in good condition and the eye bolt be inserted completely before use.

The following table is for eye bolts according to BS 4278: 1984 and gives the maximum recommended working loads for angular loading of eye bolts with links and collar eye bolts with metric threads used in pairs.

Some eye bolts, may be marked with lower safe working loads than those shown in some standards. In these cases, the reduced safe working load for angular loading when used in pairs may be obtained by using the reduction factor given at the foot of the tables for each type of eye bolt.

Table 19.4 : Maximum Working Loads for Eye Bolts with Link to BS 4278: 1984

Thread size	Axial SWL of single eye bolt	Maximum working load to be lifted by a pair of eye bolts when the included angle (a) between the sling legs is:		
Metric		$0 < a < 30^o$	$30^o < a < 60^o$	$60^o < a < 90^o$
mm	tonne	tonne	tonne	tonne
20	1.0	2.0	1.6	1.25
24	1.6	3.2	2.5	2.0
30	2.5	5.0	4.0	3.2
36	4.0	8.0	6.3	5.0
48	6.3	12.6	10.0	8.0
Reduction Factor		1.0	0.8	0.63

19.5 Lifting Without the Use of a Crane

19.5.1 General

Riggers are often required to lift, or otherwise move, loads without the use of a crane. This usually involves the use of chain hoists, ratchet and lever pullers, winches, etc., perhaps in conjunction with gin poles, sheer legs, derricks, etc. In these situations a minimum safety factor of three shall be maintained at all times.

19.5.2 Chain Hoists

As these hoists can easily be overstressed, the rules listed below shall be observed.

- Never exceed the SWL of the hoist.
- Ensure that the chain is not twisted.
- Never load the hoist when the chain is not in a true line from the hook to the main block.
- Keep the sheave pockets and the chain clean and lightly lubricated.
- If the chain jumps the sheave pockets, the chain may have stretched and shall be replaced.

- Do not suspend the load from the point of the hook or overstressing and distortion may occur.
- Mousing of the hooks is necessary to ensure they will not lose their load
- Frequently check the chain and hoist.

19.5.3 Ratchet and Lever Type Pullers

There are several types of pullers available which use chains or wire rope. To avoid overstressing, handles must never be extended or operated by more than one person at a time. When replacing wire ropes, the correct type and size of steel-core rope shall be used.

19.5.4 Gin Poles and Derricks

Gin poles consist primarily of a vertical pole, suitably stayed or guyed, and capable of being leaned out of vertical to a limited degree.

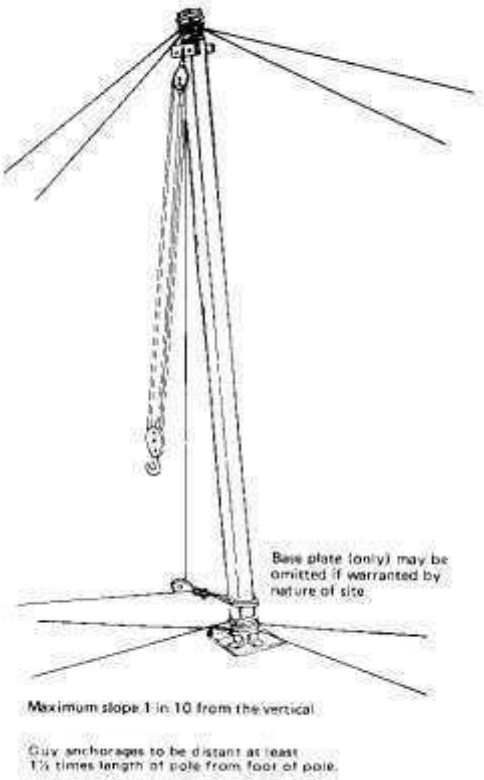


Figure 19.21: Derrick Pole

The following conditions listed below shall be complied with.

- A maximum of 1:10 slope from the vertical shall not be exceeded.
- Gin poles must be constructed of steel, with attachments at the head for suspending the load. In addition, gin poles shall be fitted with proper base plates.
- A gin pole of sufficient strength shall be used for the lifting task to prevent buckling or collapse.
- For loads greater than 10 tonnes, the guys and their end connections shall be designed by an appropriately qualified person.
- If more than one guy is used, then care must be taken to equalise the loads.
- Guys for gin poles and derricks shall be attached to proper anchorages, i.e. 'dead men' or substantial steel structures. They shall never be attached to pipelines, vessels or equipment supports.

19.5.5 Cantilevers

Cantilever beams, bolted down or held by counterweights are often used for lifting.

- No more than one third of the length of the beam shall protrude past the point of support.
- Calculations, based on the principle of moments, must be carried out an appropriately qualified person to ensure that a safety factor of three is always maintained (for consistency) in the beam and fastenings.
- Beams shall be packed to offset any change in moments due to protuberances on the surface on which the beams are resting.

19.5.6 Overhead Ropes and Flying Foxes

- Cableways with moving towers as well as flying foxes used on large construction sites shall be designed and certified as to SWL by an appropriately qualified person.
- To avoid overloading, the no-load sag shall not be less than 1/20 of the span. Under load the sag should be approximately double the no-load sag.

- The backstay angles need to be of the same slope (1 in 5) to avoid increasing the load. At steeper angles the tops of towers or poles need securing to the rope to avoid being kicked out.
- The flying fox shall have four wheels with sheave diameters not less than eight rope diameters, spaced out to avoid undue bending on the track rope.

19.5.7 Jacks and Jacking

The raising or lowering of a load by jacking is an operation that needs to be carried out with military-type precision. Generally the requirements for safe and efficient jacking are listed below:

- The jacked load shall be held steady throughout the jacking operation.
- On long loads both ends shall not be lifted simultaneously. Stabilise one end then raise or lower the other.
- If wedges are used, to level packings or load, they shall be driven tight and secured in position to prevent accidental displacement.
- Jacks shall have their SWL marked on them. In use, a margin of 25% below the SWL should be maintained.
- Jacks shall have solid timber packers on both load-bearing surfaces in order to minimise the possibility of displacement by slipping.
- The lift in all cases shall be vertical. At any sign of jack tilt, the load shall be packed and the jack reset vertically.
- Never extend jack handles as over-stressing will result thereby reducing the safe working capacity of the jack.
- On all jacks any worn parts shall be discarded and replaced to ensure the SWL capacity is not impaired in any way.

19.6 Fork Lifts

19.6.1 Introduction

The purpose of this section is to maintain a degree of safety in the use of all forklift machines operated on SUPREME ENERGY sites. Forklift machines are very dangerous when not operated in a safe manner. The safety requirements in this section and the manufacturer's safety requirements shall be followed without exception.

19.6.2 Responsibility

The Supervisor is responsible for ensuring that all forklift machines are operated by certified operators and for ensuring forklift machines are well maintained.

Forklift machine operators are responsible for ensuring that all the safe operations and work practices are understood and followed. In addition they shall comply with all relevant standards, codes of practice, procedures, and be responsible for their own safety, the safety of others, and the safety of property.

19.6.3 Operator Certification

No forklift machine is to be operated by any person unless they hold current certification of operation. Any person being trained on a forklift machine shall be under the direct supervision of a certified operator.

19.6.4 Safe Forklift Operating Procedures

- It is the operator's duty to check that the machine is in a safe and satisfactory working condition before operating the forklift and that any faults detected are reported to the person in charge.
- Operators shall not start or operate the forklift machine, any of its functions or attachments, from any place other than from the designated operator's position.
- Hands and feet shall be kept inside the operator's designated area or compartment. No part of the body shall be put outside the operator compartment of the forklift machine.
- No part of the body shall be put into the mast structure or between the mast and the forklift machine.
- No part of the body shall be put within the reach mechanism of the forklift machine or other attachments.
- It is essential that forklift machine limitations are understood and that the forklift machine is operated in a safe manner so as not to cause injury to personnel. Pedestrian safety shall be safeguarded at all times.
- Forklift machines shall not be driven up to anyone standing in front of an object.
- Operators shall ensure that personnel stand clear of the rear swing area before conducting turning manoeuvres.

- Operators shall exercise particular care at cross aisles, doorways, and other locations where pedestrians may step into the path of travel of the forklift machine.
- No one may stand or pass under the elevated portion of any forklift machine, whether empty or loaded.
- Passengers are not permitted to ride on forklift machines unless a safe place to ride has been provided by the manufacturer.
- Before leaving the operator's position:
  - bring the forklift to a complete stop
  - place directional controls in neutral
  - apply the parking brake
  - fully lower the load-engaging means.
- If the forklift machine must be left on an incline, block the wheels.
- A safe distance shall be maintained from the edge of ramps, platforms and other similar working surfaces.
- Care shall be taken not to contact overhead installations such as lights, wiring, pipes, sprinkler systems, etc.
- An overhead guard is intended to offer protection from falling objects but cannot protect against every possible impact. It shall not be considered a substitute for good judgement and care in load handling. An overhead guard shall be used on all forklift machines as protection against falling objects, unless both of the following conditions are met:
- Vertical movement of the lifting mechanism is restricted to 1800mm or less from the ground.
- The forklift machine will be operated only in an area where:
  - the bottom of the top tiered load is not higher than 1,800mm, and the top is no more than 3,000mm from the ground when tiered
  - only stable, and preferably interlocked, unitised, or containerised, loads are handled
  - there is protection against falling objects from adjacent, high stack areas.
- A load backrest extension shall be used when necessary to guard against a load, or part of it, from falling toward the operator.
- In areas classified as hazardous, only forklift machines approved for use in those areas are to be used.

- All accidents involving personnel, building structures and equipment are to be reported to the Supervisor or as directed.
- Forklift machines are not to be added to, or modified, without the manufacturer's prior written approval.
- Access to fire doors, exits, aisles, stairways or fire equipment shall not be blocked.
- Whenever a forklift machine without controls that are elevated with the lifting carriage or forks is used to elevate personnel:
  - use a securely attached work platform
  - make sure the lifting mechanism is operating smoothly and properly
  - place mast in a vertical position and never tilt forward or rearward when elevated
  - place forklift machine controls in neutral and set brake
  - lift and lower smoothly and with caution
  - watch for overhead obstructions
  - keep hands and feet clear of controls other than those in use
  - move the forklift machine only for minor adjustments in positioning when personnel are on the work platform, and never at more than creep speed
  - remain in the operator’s position on the forklift machine
  - restraining means such as rails, chains, etc should be in place, or persons on the work platform shall wear a body belt and lanyard or retractable safety device.
- Ascend or descend grades slowly, and with caution.
- When ascending or descending grades in excess of 5%, loaded rider trucks shall be driven with the load upgrade.
- Unloaded forklift machines should be operated on all grades with the load engaging means downgrade.
- On all grades the load and load-engaging means shall be tilted back, if applicable, and raised only as far as necessary to clear the road surface.
- On grades, ramps, or inclines, normally travel straight up and down, avoid turning if possible and use extreme caution.

19.6.5 Checks

A checklist is attached, (Form 19.1), as a guide for operators to use in determining that a forklift machine is safe for use. Operator's judgement is required to ensure that the machine is in a safe condition to operate. If it has defects that make it unsafe the machine shall not be used until the problem is repaired.

19.7 Manual Lifting

19.7.1 Introduction

When lifting and handling materials, it is important to know the correct method of lifting and carrying. If incorrect methods are used personnel may suffer from strains, sprains, hernias, hand and foot injuries, spinal injuries, and torn ligaments and muscles.

19.7.2 The Safest and Most Effective Way to Lift

Throughout any lifting and lowering action, follow the recommended procedures as listed.

- Check that the load is within your lifting capacity and, if necessary ask for help.
- Watch out for sharp edges, and wear gloves to protect the hands when necessary.
- If lifting something with one end heavier than the other, have the heavier end closest to the body.
- Place feet firmly, well apart, flatly on the ground, and squat down. Maintain good balance and get a good grip.
- Keep the back as straight as possible - this does not necessarily mean vertical. Lift slowly (do not jerk) by pushing with the leg muscles. Keeping the chin tucked in helps keep the back straight.
- Raise or lower the load as close as possible to the body. Avoid holding the load away from the body.
- Do not twist the body when lifting.

A strain can be caused more easily when lifting a bulky or awkward load than a compact one.

19.7.3 Safe Carrying

- Carry the load close to the body.
- Keep the back straight.
- Ensure your vision is not obscured.
- Never allow the load to interfere with normal walking. If it does, it is too heavy.

19.7.4 Stacking and Storage

- Store heavier and more frequently used items at between hip and shoulder height. Only small infrequently used items should be stored above shoulder height or below hip height.
- Stack materials so that they cannot slip or fall, by interlocking or some other method.
- Arrange stacks in clearly defined lines with working aisles or passageways between them. The height of a stack is restricted by the capability of the lower layers to withstand the weight on them.
- Chock all round objects such as drums, paper rolls and logs if they are stacked on their side.
- Check that every stack is stable.

19.7.5 Team Lifting

- It is safer for heavy, bulky or unusually long loads to use more than one person to lift them. Pairs or teams should be matched for height.
- Where more than one person is working on the lifting of a load, it is important that one person should be chosen to 'call' the lift to co-ordinate the movement and timing. This is important to avoid the weight being thrown to one side and too much weight being put on one individual leading to injury.

19.7.6 Handling of Drums

19.7.6.1 General

- Before moving a drum, stand close to the drum with feet comfortably apart and with a hand either side, then gently rock it to get the feel of it and its contents.

- Keeping back straight, knees bent and having one foot slightly forward controls the movement of the drum. Have both feet flat on the ground, tilt the drum back towards you to a point of its balance. Once on the point of balance, the drum may be moved by wheeling it along by turning it on its rim,

19.7.6.2 Lowering of a Drum

- Place both hands over the front end of the drum with the thumbs inside the rim, and the heels of the hands and the fingers over the side of the drum. The grip is important.
- Raise the rear leg and use this as a lever using the body weight in counter balance to pull the drum back towards you.
- From this position, with feet flat on the ground and far enough apart to give good balance, bend your knees and stick your bottom out, keep back straight lower drum to the ground.

19.7.7 Plank Handling

- Long loads are less easy to control than compact ones and their weight should be limited accordingly.
- A safe and comfortable method to handle a plank is to up-end the plank, keeping feet flat on the ground, stick your bottom out, lift one end of the plank and move towards the centre of the plank.
- Move with the forward end of the plank above head height especially when approaching doorways and the end of buildings so as to miss any unsuspecting person that may be hit.

19.7.8 Coils and Reels

These items can be lifted as with any other load. They are usually fairly easy to grip. Remember to keep feet flat on the ground, stick your bottom out keeping your back straight.

19.7.9 Lifting-Like Activities

- The same care should be taken with all lifting- like activities, shovelling, using a pick axe, using a wheelbarrow etc.
- Keep feet flat on the ground, at least hip width apart, stick your bottom out, knees bent within mid-range and back straight whenever carrying out these activities.

19.7.10 Shovelling

Keep one foot placed between the material to be moved and the loading point with that foot in line with the direction of material travel.

19.7.11 Use of Wheelbarrows

Remember to lift and lower the wheelbarrow using the key points of safe lifting.

19.7.12 Handling Buckets

Remember Points for Safe Lifting. Place one foot forward so that the bucket is in the 'centre of the foot position'. Lowering the bucket is the same procedure in reverse.

NOTE: Using a hose to fill the bucket may avoid the need to lift the bucket while it is filling.

19.7.13 Handling Weights from Work Benches

- Ideally, the bench should be at about waist height. Get close to the weight. Feet flat, one foot may be forward of the other. Knees may be slightly bent, back straight. Use the same principles when putting the weight back down.
- Do not leave a gap between the body and the bench when lifting or putting down the weight.

19.7.14 Lifting Aids

Wherever possible, mechanical lifting and moving appliances should be used, but make sure this equipment is used only by those who are:

- trained in the use of the appliance
- authorized to use such equipment.

19.8 Chain Hoist

Chain hoist may be used for limited duty such as light lifting, pipe jointing / welding and use not more than 50 cm height.

Factor of safety	4
Inspection	• Before use and after repair
Thorough examination	• After proof testing and at least every six months
Precautions :	• Chains shall not be joined together by using nuts and bolts. • DO NOT overload the hoist. • DO NOT exert more than the hand chain pull to lift rated load by one operator. The hoist is designed to lift its rated capacity when a reasonable force is exerted. If effort appears to be excessive, recheck the load and use a larger capacity hoist if necessary. • DO NOT side load the hoist. Make sure to pull in the straight line between hooks. Side loading the hoist over a sharp corner may fracture the hoist housing, load block or hook. • Be sure there are NO twists in the chain. Make sure that the load chain is free to move and clear all obstructions. With multiple chained hoists the load hook can be turned one or more times causing the chain to twist. • DO NOT use the hoist from an unbalanced / unstable position. Operators should have firm footing or be secured before operating the hoist. • Before raising and/or pulling a load always make sure that the slings and other rigging have sufficient capacity to support the load, and are in good condition. • DO NOT STAND BENEATH A LOAD. • DO NOT operate a load in a way to endanger personnel. • DO NOT leave the hoist with a suspended load. • DO NOT wrap the load chain around the load. USE A SLING. • DO NOT TIP-LOAD the hook, as this will exert undue strain, resulting in hook failure. • The hoist is designed for manual operation by one person only. DO NOT use the hoist with another power besides the manual power from one person. • DO NOT USE HOIST TO LIFT, SUPPORT OR OTHERWISE TRANSPORT PEOPLE. • The hand chain has a safety latch. When the safety latch opens or deforms, stop immediately to find out the cause. • Hoists are designed to lift loads vertically and SHOULD NOT be used for horizontal or angle hoisting. • NEVER use the chain or hook as a ground welding. • Use only parts and chains supplied by an authorized distributor.

Form 19.1 : Mobile Crane Plan

The following points need to be considered and if required a sketch drawn of the nearby hazards and the path of the load.
• Ground conditions (stability) • Underground services • Overhead lines/services • Communications/crane control • High energy systems (steam lines ….) • Causing an obstruction (i.e. fire exits ……) • Access to site • Hazardous areas (complete a 'Hazardous Area Permit')
(Sketch Plan)

Form 19.2 : Operator's Checklist for Forklift Machines

All Forklift Machines

1. Hour meter
2. General Lubrication
3. Steering
4. Tyres
5. Brakes
6. Brake fluid
7. Hydraulic controls
8. Hydraulic rams
9. Hydraulic systems
10. Lifting chains, pulleys, and wire ropes
11. Forks and retaining pins
12. Overhead guard and load backrest

Battery Powered Forklift Machines

1. Battery plug connection
2. Battery charge and electrolyte
3. Battery load test

Engine Powered Forklift Machines

1. Fuel Level
2. Oil level and pressure
3. Water level and fan belt

LPG Powered Forklift Machines

1. LPG gas cylinder secure
2. Safety relief valve positioned correctly
3. Fuel in cylinder
4. Check regulator hose and fittings
5. Fuel Level
6. Oil level and pressure
7. Water level and fan belt