



# Engineering Standard

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SAES-T-603

25 April 2012

Telecommunications – Safeguards and Warning Devices

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Document Responsibility: Communications Standards Committee

## Saudi Aramco DeskTop Standards

### Table of Contents

I	Scope.....	<a href="#">2</a>
II	Conflicts and Deviations.....	<a href="#">2</a>
III	References.....	<a href="#">2</a>
IV	Safeguards and Warning Devices .....	<a href="#">3</a>
V	Installation.....	<a href="#">10</a>
VI	Testing and Inspection.....	<a href="#">10</a>
	Exhibit 1 – Procedures to Complete Trouble Restoration.....	<a href="#">12</a>

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Revised paragraphs are indicated in the right margin

Primary contact: Abdullatif, Abduladhim H. on 966-3-8801356

Page 1 of 17

## I Scope

This Standard prescribes Mandatory Requirements governing the use of safeguards and warning devices in the construction of telecommunication outside plant (OSP) facilities.

## II Conflicts and Deviations

Any deviations, providing less than the mandatory requirements of this standard require written waiver approval as per Saudi Aramco Engineering Procedure [SAEP-302](#).

## III References

All referenced Specifications, Standards and Codes, Forms, Drawings and similar material shall be of the latest issue (including all revisions, addenda and supplements) unless stated otherwise. Applicable references are listed below:

### A. Saudi Aramco References

Saudi Aramco Engineering Procedure

[SAEP-302](#)

*Instructions for Obtaining a Waiver of a  
Mandatory Saudi Aramco Engineering  
Requirement*

Saudi Aramco Engineering Standard

[SAES-T-628](#)

*Underground Cable*

Saudi Aramco General Instructions

[GI-0002.100](#)

*Work Permit System*

[GI-0002.709](#)

*Gas Testing Procedures*

[GI-1021.000](#)

*Street and Road Closure, Excavations,  
Reinstatement and Traffic Controls*

[SACSM](#)

*Saudi Aramco Construction Safety Manual*

Ministry of Transportation-Highway Design Manual

### B. Industry Codes and Standards

National Fire Protection Association

[NFPA 329](#)

*Underground Leakage of Flammable and  
Combustible Liquids*

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American Petroleum Institute

[API 4149](#)

*The Migration of Petroleum Products in Soil and Ground Water*

Building Industry Consulting Services International

[BICSI TDMM](#)

*Telecommunications Distribution Methods Manual*

[BICSI OSP](#)

*Building Industry Consulting Services International, Outside Plant Reference Manual*

## IV Safeguards and Warning Devices

### 4 Design

#### 4.1 Removing Petroleum Products from Manholes and Underground Conduit Systems

##### 4.1.1 General

This section provides the:

- Procedures for removing petroleum products (e.g., gasoline, diesel fuel) from manholes and underground conduit systems, before any work start.
- Precautions that should be followed to avoid accidents.

##### 4.1.2 Reference Material

##### 4.1.2.1 In order to safely perform the procedures outlined in this section, the craft personnel must be familiar with the information contained in the following sections:

[SAES-T-603](#)

*Safeguards and Warning Devices*

[SAES-T-628](#)

*Paragraph 4.4 Underground Cable Installation Precautions Paragraph 4.6, Testing and Ventilating Manholes*

*NFPA 329*

*Underground Leakage of Flammable and Combustible Liquids*

*API 4149*

*The Migration of Petroleum Products in Soil and Ground water*

*SACSM*

*Saudi Aramco Construction Safety Manual*

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<i>BICSI TDMM</i>	<i>Building Industry Consulting Services International, TDMM (Telecommunications Distribution Methods Manual)</i>
<i>BICSI OSP</i>	<i>Building Industry Consulting Services International, OSP (Outside Plant Reference Manual)</i>
<i>GI-0002.100</i>	<i>Work Permit System</i>
<i>GI-0002.709</i>	<i>Gas Testing Procedures</i>
<i>GI-1021.000</i>	<i>Street and Road Closure: Excavations, Reinstatement and Traffic Controls</i>

#### 4.1.3 Responsibilities:

4.1.3.1 A Saudi Aramco supervisor must directly supervise all petroleum products removal work performed by Contractor at the job site. In the event of gas detection in the work area, all workmen must immediately leave the work area and the incident reported to the work permit issuer. Workmen may not re-enter the work area until the area is cleared and a new work permit is issued.

4.1.3.2 The petroleum proponent is responsible for locating and clearing the source of a petroleum spill or leak affecting the telecommunication infrastructure system.

#### 4.1.4 Removing Petroleum Products from Underground Conduit System.

4.1.4.1 When petroleum products are found in a manhole, inspect the area to determine the:

- Slope of the terrain.
- Probable number of manholes involved.

#### **Warning:**

Fumes from petroleum products may be toxic and highly flammable. As a result:

- Do not enter the manhole until tests with a portable gas detector show the atmosphere is safe. Refer to GI-0002.709, Gas Testing Procedures and GI-0002.100 Work Permit System. Continuously ventilate the manhole with a power blower to keep the atmosphere safe.
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*Commentary Note:*

See [SAES-T-628](#), paragraph 4.6, *Manhole Testing and Ventilating*.

- While working around the manhole, avoid breathing the fumes or causing a spark, which may ignite the product.
- Smoking shall not be allowed within the vicinity of the manhole.
- All electrical switching connections and disconnections must be made outside a manhole, at least 3 meters from the manhole opening.

#### 4.1.5 Initial Inspection

4.1.5.1 If it is determined that a manhole contains a petroleum product, the following procedures should be followed:

- 1) Do not enter the manhole and stop the work.
- 2) Notify the work permit issuer, Saudi Aramco Fire Prevention Engineer, the responsible Saudi Aramco Project Engineer and Communication Operations & Maintenance Department of the existing manhole's condition and location.
- 3) Warn people passing by of the danger until the proponent, Security or Loss Prevention Department takes charge.
- 4) Use plastic duct seal to seal the openings in the manhole cover and the space between the cover and the frame.
- 5) Ensure that the work area warning devices are proper and adequate.
- 6) Do not enter the manhole until it has been declared safe by proper authorities and a new work permit has been issued.

4.1.5.2 The Loss Prevention Department or other departments having jurisdiction will usually:

- Direct further work required to remove the petroleum product.
- Inspect and analyze the product to determine its source.
- Perform any other procedure deemed necessary.

4.1.5.3 Plug the ducts and begin construction after the manhole and ducts, if involved, have been:

- Flushed.
  - Pumped.
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- Made safe for entry (i.e., tested and ventilated) and
  - A new work permit issued.
- 4.1.5.4 For procedures on how to complete trouble restoration refer to Exhibit 1.
- 4.1.5.5 No work can be done in the manhole(s) until the source of the petroleum product has been identified, the leak stopped and authorization to proceed has been obtained from the Loss Prevention Department. In addition a new work permit must be issued.
- 4.2 Detector and Monitor Combustible Toxic Gas and Oxygen Deficiency.
- 4.2.1 Gas Testing and Instruments use must comply with Loss Prevention Department Procedures. Refer to GI-0002.709 including Supplements 1, 2 & 3.
- Supplement 1 - Use of Bacharach Model K-25 Oxygen Indicator.
- Supplement 2 - Use of J-W Sniffer Model G Combustible Gas Indicator.
- Supplement 3 - Use of Dragger Multi-Gas Detector - H<sub>2</sub>S Testing.
- Commentary Note:*
- Any additional Gas Testing Instruments (Models) used must be approved by Loss Prevention Department.*
- 4.3 Removing and Replacing Manhole Covers Safe Working Methods.
- 4.3.1 Safety Precautions
- 4.3.1.1 Take the following precautions when removing or replacing manhole covers:
- Before removing manhole covers, be sure the proper safeguards and warning devices have been placed to adequately protect the location against accidents. Refer to GI-1021.000.
  - Conduct the prescribed atmospheric gas testing and ventilating of the manhole as described in GI-0002.709, including Supplements 1, 2 & 3 and [SAES-T-628](#).
  - Removing a manhole cover should never be attempted without a standard manhole hook on hand. Use extreme caution since many existing manhole covers are non-standard. Never use a large screw-driver, pickax or crow-bar when attempting to remove the cover. Non-standard covers should be replaced.
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- Existing non-standard covers found at site during the construction should be reported to Communication Operations & Maintenance Department for replacement.
- Never leave an open manhole unattended for even a short time. Always replace the cover before removing guards and warning devices.
- Manhole covers are heavy and must be handled with care to avoid personal injury. When handling a cover, keep your feet solidly placed and positioned so they will be clear of the cover if you drop it.
- Do not use an open flame in or around a manhole or over a manhole cover. An open flame is hazardous because of the possibility of an explosion if a combustible mixture is present in the manhole.
- Because of the hazard of sparks never strike a seated cover directly with a steel or iron implement.

*Commentary Note:*

*To loosen a cover that will not lift readily. First be sure the cover is not locked by a locking bolt. Then place a block of wood on the cover near the rim and strike it with a heavy hammer. Do this at several points around the circumference while the other workman pries the cover with a bar or a manhole hook inserted in one of the hook holes.*

#### 4.4 Safeguards to be Taken before Climbing Poles

4.4.1 Before poles are climbed, a visual check must be made for pole conditions such as; leaning of a pole, evidence of collision damaged pole, broken or loose wire & guys, contact of power wires or other plant on the pole.

4.4.2 Poles found to be unsafe or suspected of being unsafe to climb or work on, shall not be climbed and are to be reported to immediate supervisor. A danger sign (Figure 4) shall be used to warn against the hazards of climbing the pole. The danger sign must be placed below the pole number and facing oncoming traffic.

4.4.3 If the pole has been broken, resulting in an unsafe condition and requiring immediate support, steps should be taken to warn the passerby.

*Commentary Note:*

*All personnel who will be climbing or working on poles shall review the Construction Safety Manual, Section IV, paragraphs 1.6 and 1.6.11.*

#### 4.5 Safeguard & Warning Devices, Guarding Work Areas - Underground, Buried & Aerial Plant

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#### 4.5.1 General

4.5.1.1 This section provides general information relative to guarding work areas which are potentially hazardous to vehicular or pedestrian traffic.

4.5.1.2 Refer to GI-1021.000 and Schedule "D" of the Saudi Aramco Construction Safety Manual. They outline the instructions and procedures to be used during street and road closures, excavations, and traffic controls.

#### 4.5.2 Warning Devices

4.5.2.1 The following paragraphs describe the work area guards and warning devices which are to be used by telecommunication personnel at work locations involving underground, buried, or aerial plant.

*Commentary Note:*

*It is necessary that all maintenance personnel or contractors working on telecommunication facilities display and use these warning devices.*

#### 4.5.2.2 Personnel Protective Equipment

4.5.2.2.1 Protective equipment is to be worn by personnel during highway flagging Operations or whenever the work area exposes personnel to hazardous traffic conditions. Refer to GI-1021.000 and Schedule "D" of the Saudi Aramco Construction Safety Manual.

#### 4.5.2.3 Work Area Guards

4.5.2.3.1 Manhole guards (Figure 1) are to be used to guard open manholes and other small obstructions. This unit is constructed of 3/4-inch pipe painted yellow. The "No Smoking" sign must also be attached to all manhole guards. The manhole ladder (if used) should be placed so that the worker faces oncoming traffic during entrance to or exit from the work area. Refer to Section II paragraph 9.1.4 and 9.2 in the Saudi Aramco Construction Safety Manual.

4.5.2.4 The manhole shield (Figure 2) may be installed to keep water and windblown trash out of the manhole. One size fits 27-inch or 30-inch manholes by merely turning the shield over.

4.5.2.5 Warning standards, 'Men Working', with Yoke and Flag (Figure 3; GI-1021.000) are to be used to alert oncoming traffic to the presence of telecommunication personnel.

4.5.2.5.1 The warning sign itself must conform to the specifications described in part 4.5.3. All signs are to be reflectorized, 36 by 36 inches or 48 by 48 inches in size, as specified by the Ministry of Transportation-Highway Design Manual.

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- 4.5.2.5.2 A roll-up curtain sign may be used in place of the standard sign when approved by Ministry of Transportation-Highway Design Manual. These signs are 48 by 48 inches of good quality material containing an orange background with black lettering.
- 4.5.2.5.3 The flag yoke mounts on the upper tube of the warning standard to hold three warning flags for daytime use.
- 4.5.2.6 The red warning flag (Figure 4; GI-1021.000) is the most common signaling device used during daylight hours. It shall be used by flaggers to direct traffic or placed in the yoke of the warning standards.
- 4.5.2.7 The reflectorized traffic cone; Figure 5; shall be used to provide motorists with advance notice as they approach work areas, or to guide traffic into restricted channels around a work area with a minimum of congestion.
- 4.5.2.8 A barricade (Figure 6, GI-1021.000) shall be used to warn and alert drivers of hazards created by work activities in or around the traveled way. A flasher is mounted on the traffic side for use during darkness or low-visibility conditions. Barricades and flashers used in plant areas must be approved for location of use.
- 4.5.3 Signs and Symbols
- 4.5.3.1 Signs and symbols that are most commonly used to warn oncoming traffic of an approaching work area are essentially those contained in GI-1021.000 and the Saudi Aramco Construction Safety Manual.
- 4.5.3.2 Commonly Used Road Construction Signs are 900 by 900 mm (36" by 36") in size. Refer to GI-1021.000 and the Kingdom of Saudi Arabia Ministry of Transportation-Highway Design Manual.
- 4.5.3.3 All construction and maintenance signs shall be black on an orange background. Those signs intended for use during darkness or low-visibility conditions shall be reflectorized or illuminated.
- 4.5.4 Precautions
- 4.5.4.1 A flagger(s) shall be used at all times when the work operation restricts traffic flow or obscures visibility.
- 4.5.4.2 Warning devices shall be arranged so that they do not create a hazard for pedestrians.
- 4.5.4.3 Efforts should be made to close all holes in earth either permanently or temporarily before leaving the work locations. If this is not possible, the
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holes should be fenced with snow fence or equivalent or an employee should be posted at the site to prevent accidents.

- 4.5.4.4 When a motorist cannot see the work area from the vicinity of the initial warning sign, because of natural obstacles (hills, curves, etc, ) a mast with flags should be placed at the location of the initial warning sign location in addition to those at the work are.
- 4.5.4.5 Communication construction crews or contractors will not work (moving operation: aerial cable, aerial wire, etc.) in a direction opposing vehicular traffic flow. Plan to move operations in the direction of traffic flow.
- 4.5.5 Job Pre-survey
  - 4.5.5.1 At busy intersections of highways and roads or other heavy traffic locations, the supervisor shall pre-survey the locations and discuss the protection plan indicated in Saudi Aramco Construction Safety Manual with the work force before work is started.
    - 4.5.5.1.2 Contact Saudi Aramco Road Division's traffic engineer for advice in developing detour, flagging Operations and signing plans. Refer to GI-1021.000.
    - 4.5.5.1.3 Place the initial traffic control warning devices far enough ahead of work areas to give approaching motorists sufficient time to prepare for a stop or reduced speed zone.
- 4.5.8 Control Device Applications
  - 4.5.8.1 Refer to Saudi Aramco Construction Safety Manual and GI-1021.000 for application of traffic warning devices when work is underground, buried plant and aerial plant work on Saudi Aramco roads, off-road, streets and alleys. A typical example is shown in (Figure 7).

## **V Installation**

Installation of safeguard and warning devices shall be in accordance with this standard, the Construction Safety Manual, GI-1021.000 and other applicable standards.

## **VI Testing and Inspection**

- A. The Saudi Aramco Inspection Department will inspect the installation of all sign and barricade placements per paragraph 5 above.
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- B. Gas Testing Procedures shall be in accordance with GI-0002.709 including Supplements 1, 2 and 3.

**Revision Summary**

11 May 2009	Revised the "Next Planned Update". Reaffirmed the contents of the document and reissued with minor revision.
13 June 2010	Editorial revision to change the Primary Contact Person and remove the committee members list.
25 April 2012	Editorial revision to change the primary contact.

## Exhibit 1 – Procedures to Complete Trouble Restoration

To complete the trouble restoration performs the following steps:

### STEP 1:

Inspect the adjacent manholes to determine:

- Whether the duct runs should be flushed.
- In which direction the flushing should be done. This will be determined by the terrain.

#### For example:

- If the adjacent manhole is clear of petroleum products but has a lower elevation than the contaminated manhole, the duct run should be flushed toward the uncontaminated manhole.

OR

- If the adjacent manhole is clear of petroleum product but has a higher elevation than the contaminated manhole, the duct run should be flushed toward the contaminated manhole.

OR

- If the adjacent manhole is contaminated remove the petroleum product and flush the manhole, then proceed to its adjacent manhole to determine the direction in which the duct runs should be flushed (this will depend on the elevation.)

### STEP 2:

Select the most convenient water source option to remove residual petroleum product from duct runs.

**WARNING:** Before entering the manhole to flush the duct runs, test the atmosphere of the manhole with a gas indicator approved for this purpose. Do not enter the manhole until tests show a safe condition.

### STEP 3:

Plug the ducts on the downhill side of the adjacent manhole to prevent the need for additional flushing, and the residual petroleum product from spreading further.

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**STEP 4:**

Flush the duct runs by inserting the tip of the high-pressure nozzle inside the ducts and flushing toward the lower elevation. Flush all duct runs for several minutes.

***NOTE:** If the duct run is occupied and the water stream cannot be injected then flood the manhole with water and pump until the water and petroleum mixture is removed.*

**STEP 5:**

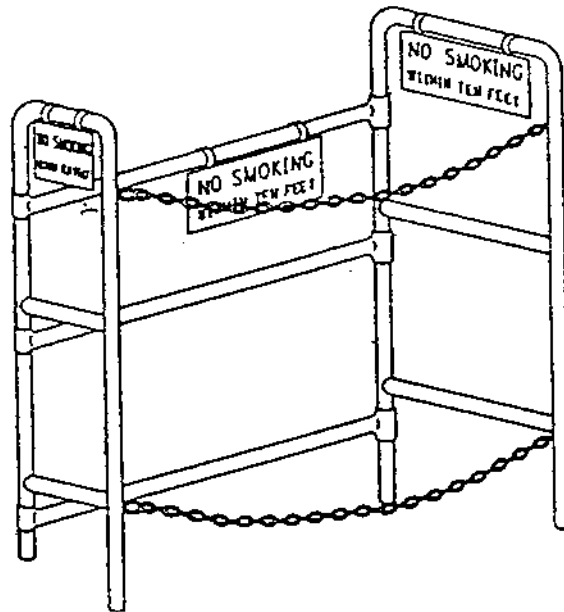
Remove the water and petroleum mixture.

**STEP 6:**

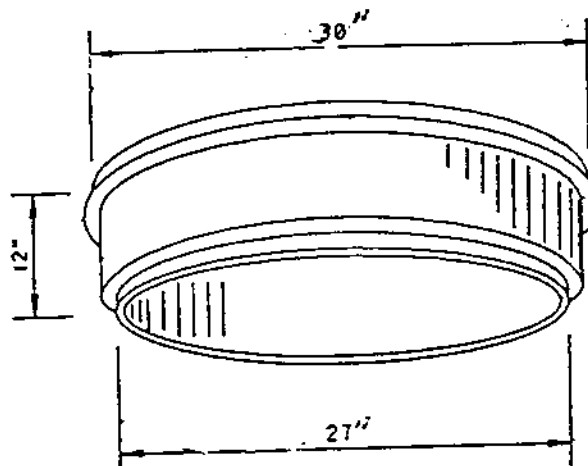
Re-flush the manhole(s).

**STEP 7:**

Remove the water.



**Figure 1 - Manhole Guard (No Smoking Sign)**



**Figure 2 - Manhole Shield**

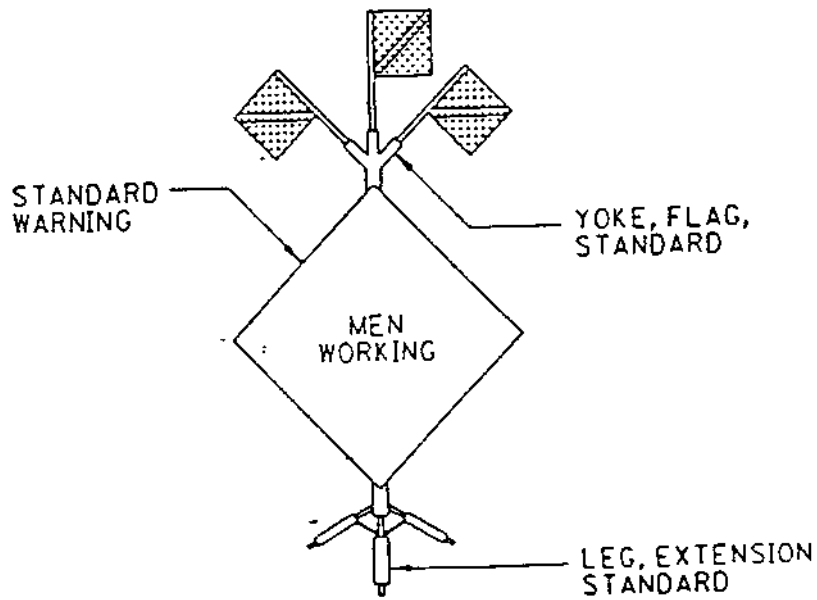


Figure 3 - Warning Standard

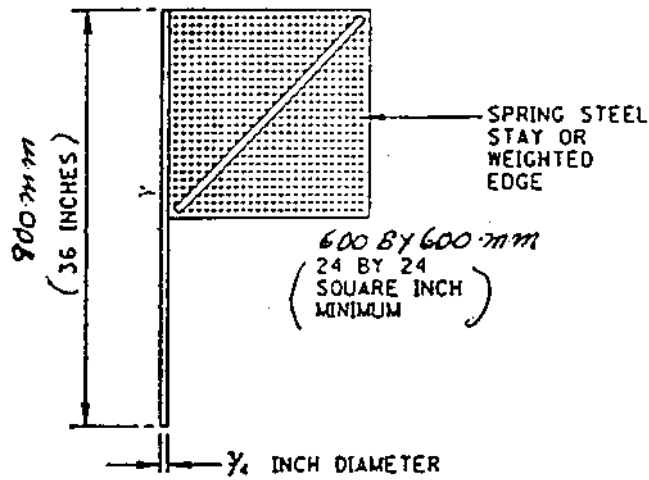


Figure 4 - Red Warning Flag

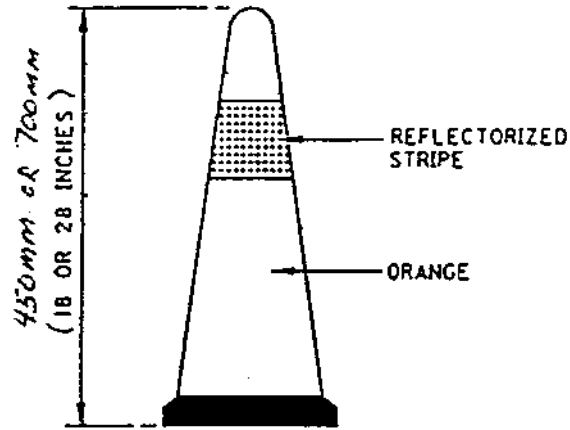


Figure 5 - Traffic Cone

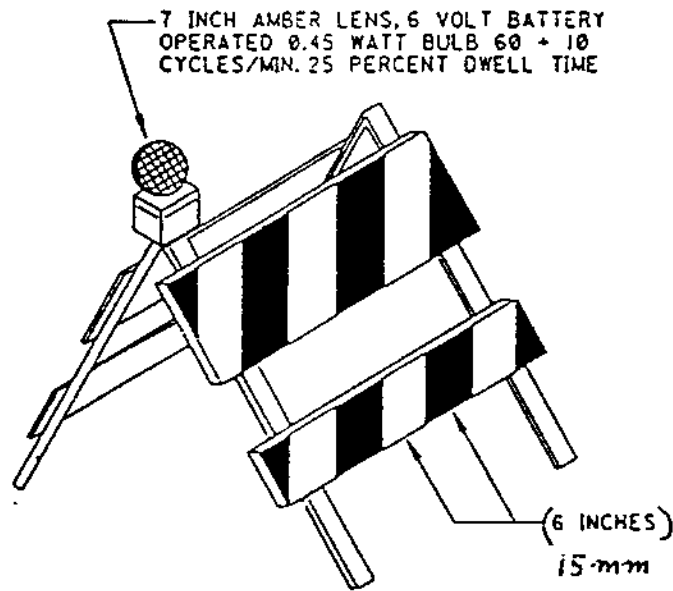
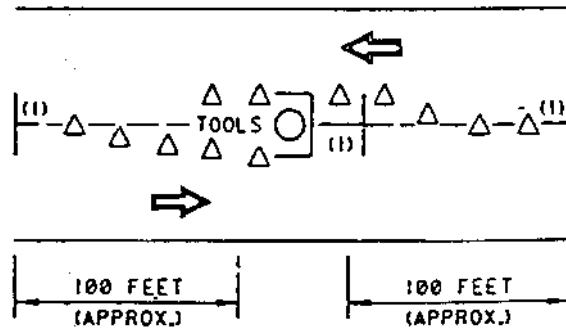


Figure 6 - Portable Barricade





**Figure 7 - No Cars Parked at Curbs**