Lesson template – Fall arrest systems VER 1.8 01/08/2002 © Copyright 1999-2005

**Topic / Subject**  
TYPE 1 FALL-ARREST DEVICES

**Time frame** = ______ mins

**Contact statement**  
(gain student attention and create a readiness to learn)

**Overview (key points)**

- **Purpose**  
  - Fall-arrest devices are designed to allow a person to perform work at height with mobility.  
  - The type 1 designator refers to a fall-arrest device which travels along a fixed line and locks to the line when loaded. Such devices can only be loaded in the direction of the line.  
  - AS 1891.3 is the Australian Standard which applies to fall-arrest devices.

- **Components**  
  - Gate  
  - Gate latch or pin  
  - Safety catch/pin  
  - Screw mechanism  
  - Guide roller  
  - Connecting ring  
  - Spring  
  - Cams/Jaws

- **Types**  
  - Removable  
  - Non removable  
  - Single cam Vs Twin cam design

- **Materials**  
  Generally, fall-arrest devices are made from electroplated or hot dip galvanised steel or stainless steel.

  - Steel (stronger, robust, but susceptible to corrosion)  
  - Stainless steel (ideal material but usually more expensive)  
  - Alloy (light-weight, resistant to corrosion, not as strong as steel)

- **Operation / Use**  
  - All fall arrest devices are designed to operate with a particular diameter of rope. Use the wrong diameter of rope and device may not function correctly!  
  - Very few devices can tolerate a wide range of diameter ropes! A notable exception is the Komet Kibloc (as at 01/04/2002).  
  - The device must be oriented correctly – check instructions for use. If the device is attached upside down, it may fail.  
  - Removable devices typically require two (2) movements to attach or detach from the rope (eg by unscrewing a knob and flipping and safety catch)  
  - An energy absorbing lanyard is normally used in conjunction with the device to limit the force of a fall to 6KN.
Markings
Since virtually all type 1 fall-arrest devices are made overseas, the European standard markings will appear on the device.
- Traceability and the CE mark – note serial number
- EN standards
  - EN 353-1 = Guided type fall-arrester on rigid rail
  - EN 353-2 = Guided type fall-arrester on flexible line
- AS 1891.3 is the equivalent Australian Standard
- Year of manufacture
- Working load limit (WLL) Vs Ultimate strength
- kN (kilonewton)
- Various arrows and arrows indicating the correct orientation for use

Care and maintenance
- Use fall arrest devices in accordance with their design limitations (don’t subject to ‘cross-load’)
- Avoid dropping – impacts can cause serious damage
- Frequency of maintenance / cleaning
- CRC or graphite are satisfactory lubricants – avoid using grease
- Reasons for retirement
- Lifespan
Topic / Subject  TYPE 2 FALL-ARREST DEVICES

Time frame = ______ mins

Contact statement (gain student attention and create a readiness to learn)

Overview (key points)

• Purpose
  - Fall-arrest devices are designed to allow a person to perform work at height with mobility.
  - The type 2 designator refers to a fall-arrest device from which a spring loaded anchorage line pays out and which locks when loaded and releases when the load is removed. The principle of operation is like a seat belt in a car.
  - AS 1891.3 is the Australian Standard which applies to fall-arrest devices.

• Components
  - Main body of unit
  - Pay out line (usually webbing)
  - Attachment hook (requires 2 separate movements to open)
  - Spring mechanism
  - Anchorage hardware (usually a carabiner)

• Types
  Type 2 fall-arresters can be broadly categorised by the type of pay out line used. The two types are:
  1. Webbing (3-5m in length) – lightweight design; and
  2. SWR cable (5m+) – Robust, heavy duty design

• Materials
  The pay out line will be either soft webbing material or SWR cable. In both designs, the pay out line feeds out and retracts back into the body of the unit.
  - Webbing = Not suitable for falls over sharp edges
  - SWR cable = More robust, can tolerate abrasive environments or falls over edges.

• Operation / Use
  - Type 2 fall arrest devices are designed to be attached to a solid and reliable anchorage usually in an overhead position.
  - The main body of the unit remain in a fixed position at the anchorage.
  - The spring loaded pay out line simply reels out as the worker moves about.
  - An energy absorbing lanyard is normally used in conjunction with the device to limit the force of a fall to 6kN.
• **Markings**
  - Traceability and the CE mark – note serial number
  - EN 360 is the European standard that applies to retractable fall-arrest devices
  - AS 1891.3 is the equivalent Australian Standard
  - Year of manufacture
  - Working load limit (WLL) Vs Ultimate strength
  - kN (kilonewton)
  - Some units have an integrated energy absorber built-in

• **Care and maintenance**
  - Use fall arrest devices in accordance with their design limitations
  - Avoid dropping – impacts can cause serious damage
  - Frequency of maintenance / cleaning
  - Reasons for retirement
  - Lifespan
HORIZONTAL LIFE-LINES (flexible type)

Time frame = ______ mins

Contact statement (gain student attention and create a readiness to learn)

Can use:
- analogy of a Tyrolean traverse used by mountaineers – the principles of horizontal lifelines originate from the classic tyrolean rope traverse still used by mountaineers and rock climbers today (eg the Totem pole in Tasmania requires the use of a tyrolean to exit from the impressive sea stack); or
- analogy of a flying fox – relate any childhood experiences in riding a flying fox. Principles are similar.

Overview (key points)

- **Purpose**
  - Horizontal life-lines are designed to allow a person to perform work at height with mobility.
  - Flexible life-lines may be either:
    - webbing
    - low stretch (‘static’) fibre ropes meeting requirements of AS 4142.3
    - dynamic ropes meeting the requirements of EN 892
    - hawser lay fibre ropes (also meeting the requirements of AS 4142.3)
    - steel wire rope (SWR) meeting the requirements of AS 3569
      
      **Exception:** SWR made from stainless steel

- AS 1891.2 is the Australian Standard which applies to horizontal life-lines.

- **Components**
  (Refer to AS 1891.2 Supp 1:2001, Figure 1)

  - End anchorage
  - Line tensioning device
  - Flexible line (webbing, fibre rope or SWR)
  - Intermediate anchorages
  - Mobile attachment device
  - Lanyard assembly (attached to user) – may be double lanyard type to allow passage past intermediate anchorages (refer to figure 2 in AS 1891.2 Supp 1)
  - Fall arrest harness worn by user (EN 361 or AS 1891.1)

- **Installation considerations**
  Need to consider if particular job at height requires a permanent or temporary horizontal life-line.

  - Permanent (discuss)
    - For systems likely to be in use for 6 months or longer, a ‘system information plate’ shall be displayed at each regular entry point to the system. The plate must provide the following minimum information: (refer AS 1891.2 Supp1:2001 clause 8.1(d) )
      a) manufacturer’s and installer’s name and installation date
      b) a unique identification number
      c) an instruction that a personal energy absorber or a fall-arrest device with built-in energy absorbing properties must be used
      d) any special instructions for use
      e) maximum number of users allowed on any one span at once
      f) servicing requirements together with inspection and servicing intervals and the dates on which they are to be carried out
      g) system termination date – unless re-certified by a competent person as safe for continued use. This date shall be no more than 10 years from the date of original installation or not more than 5 years from any subsequent re-certification.
- Temporary (discuss)
  - In many instances, a temporary horizontal life-line will afford a more viable solution, eg roof workers.

  - Fibre rope or SWR may be chosen – typically, fibre rope is easier and cheaper to install.

  - Sixteen (16) to nineteen (19) mm diameter ‘double braid’ yachting rope is commonly used.

  - A suitable line tensioning device will simplify its installation – caution is needed to avoid over tensioning the line. Excessive line tension will result in very high forces being transmitted to each end termination anchorage.

- Retro fitted Vs Built in systems
  - The ideal approach is to install a permanent life-line as part of the building during its construction. Many States/Territories make provisions in their respective building codes for permanent fall-protection solutions.

  - The fact remains that many older buildings simply do not have any system of fall-protection pre-existing. The worker must install a suitable solution.

  - Discuss existing or proposed solutions with students in the context of their workplace.

- **Attachment hardware**
  - A number of different types of attachment hardware may be used in installing a horizontal life-line. The exact type of equipment will depend on whether the system is to be permanent or temporary.

  - Eg,

    - Permanent systems:
      - SWR cable (refer to AS 1891.2 Supp1:2001 Table 1)
      - Line tensioning device (refer AS 1891.2 Supp1:2001 Figure 7)
      - Wedge sockets (refer AS 1891.2 Supp1:2001 Figure 8)
      - Thimble eyes (refer AS 1891.2 Supp1:2001 Figure 8)
      - Double throated clamps (refer AS 1891.2 Supp1:2001 Figure 8)

    - Temporary systems:
      - Synthetic fibre rope (at least 16mm in diameter)
      - Web slings (have examples on hand)
      - Carabiners (demonstrate correct use)
      - Line tensioner (usually a robust design rope grab)

- **System design parameters**
  - (Refer to AS 1891.2 Supp 1:2001, Figure 1)

  - Anchorage forces: What is the maximum predicted force that the system could be subjected to?

    - 100m is the maximum overall length permitted by AS 1891.2 with 10m intervals between intermediate anchorages. The life-line must run freely through each intermediate anchorage point.

    - According to AS 1891.2, no more than four (4) persons may use the system at any one time and no more than two (2) persons using any single span (see AS 1891.2 Supp1:2001, clause 5(e) ).

    - Minimum fall clearance is illustrated in AS 1891.2 Supp1:2001, Figure 6. Generally, after all factors have been taken into consideration, at least one (1)m clearance from striking any object (eg the ground).
**Operation / Use**
- In terms of risk, the most likely place for accidents are the entry/exit points to the system and when passing intermediate support anchorage points. A double hook/lanyard assembly may be necessary to pass intermediate anchorage points.

- Some mobile attachment devices are specially designed to run freely along the length of the horizontal life-line without the need for user intervention to bypass intermediate support anchorage points (eg the ‘latchways’ system). However, these systems are generally more expensive to install.

- Specific forces and limitations are given in AS 1891.2 Supp1:2001 Tables 1, 2, & 3.

- The ‘system information plate’ will indicate any other special instructions for use in the case of permanent life-lines.

- The limitations of temporary life-lines will largely be determined by the structural integrity of the underlying support material to which the end termination anchorages are connected. Domestic roofs may be timber frame or metal frame and in varying states of disrepair. A high degree of judgement is required in deciding how best to use the system.

**Testing**
Given by AS 1891.2: 2001
- Appendix A (static test method)
- Appendix C (dynamic test method)

**Inspection and maintenance**
Refer to AS 1891.2 Supp1:2001 clause 9.

**Exercise**
1. Have students refer to AS 1891.2 :2001 (including the supplement)
2. Ask students several questions with regard to a particular requirement for the installation/use of a horizontal life-line
3. Ask students to define a particular word or phrase
   Eg ‘flexible line’, ‘horizontal lifeline system’, ‘competent person’, ‘end anchorage’ etc.

Be careful not to supply all the answers to your students – let them find the answers.