

## VI. Practical Examples of using Safety Belts and their Anchorage

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### (1) Example of using Fixed Anchorage



Photo 1 - windows cleaning work using full-body harness and fixed anchorage



Photo 2 - an eye-bolt as the fixed anchorage

(2) Vertical Independent Lifeline



Photo 3 - external window panel installation work using rope chuck and vertical independent lifeline



Photo 4 - bamboo scaffolding  
e r e c t i o n /  
d i s m a n t l i n g u s i n g  
r o p e c h u c k a n d  
v e r t i c a l i n d e p e n d e n t  
l i f e l i n e



Photo 5 - metal scaffolding  
e r e c t i o n /  
d i s m a n t l i n g u s i n g  
r o p e c h u c k a n d  
v e r t i c a l i n d e p e n d e n t  
l i f e l i n e

(3) Guide Rope



Photo 6 - electrical  
t o w e r  
assembling  
work using  
guide rope,  
rope grab and  
rope adjuster



Photo 7 - the rope tension adjuster used in  
tensioning the guide rope

(4) Retractable Fall Arrester



Photo 8 - inertia reel (retractable fall arrester) used in container handling work

(5) Guided Type Fall Arrester on a Rigid Anchorage Line



Photo 9 - guided type fall arrester on a rigid anchorage line used in power generation plant

## Appendix 1

### Safety Harness or Full Body Harness

#### (a) Full Body Harness under EN 361:2002

Under the European Standard, EN 361:2002, it is a body support for fall arrest purpose, i.e. a component of a fall arrest system which is to support the whole body of a person and to restrain the user during a fall and after the arrest of a fall. It consists of shoulder strap, sit strap, thigh strap and back support for work positioning. The width of sit strap and shoulder strip shall be at least 40 mm. Straps shall not migrate from position and shall not loosen by themselves. The fall arrest attachment element such as D-ring, may be placed so as to lie, during the use of the full body harness, in front of the chest, at the center of gravity, at both shoulders, and/or at the back of the user. Figure 13 shows a full body harness under this standard.

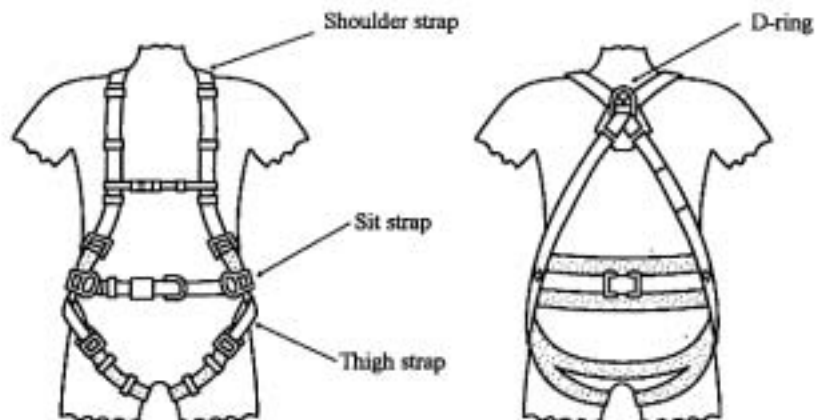


Figure 13 A Full Body Harness (EN)

In the standard, it specifies that during the drop test, the torso dummy shall be arrested in a head-up position and the angle between the longitudinal axis of the dorsal plane of the torso dummy and the vertical shall be a maximum of 50 degree.

When it works with a lanyard, the length of lanyard, including energy absorber, if applicable, and termination, e.g. connectors or eyes, shall not exceed 2 metres.

**(b) Safety Harness under AS/NZS 1891.1:1995**

Under Australian/New Zealand Standard, AS/NZS 1891.1:1995, safety harness under this standard is known as fall-arrest harness which comprises of a single assembly of interconnected shoulder and leg straps. The harness may incorporate a body belt or other horizontal straps designed to provide a bearing area on the body to prevent the user falling out of the harness during a fall. The shoulder straps is positioned so that, when the person is suspended, they shall not transmit undue pressure to the area of the body under the armpits.

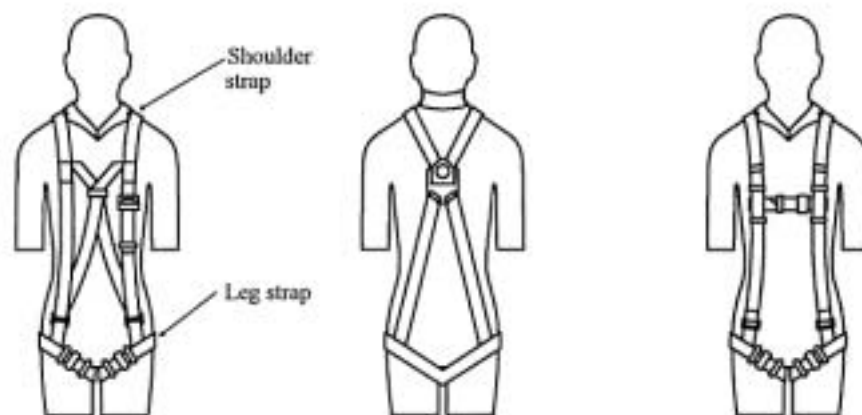


Figure 14 Full Body Harness without horizontal straps  
(AS/NZS)

The harness incorporates attachment hardware for attachment to the lanyard assembly. The hardware locates in such a position that the user, whether conscious or unconscious, is retained in the head-up position in the event of fall. A typical fall-arrest harness is illustrated in Figure 14 and Figure 15.

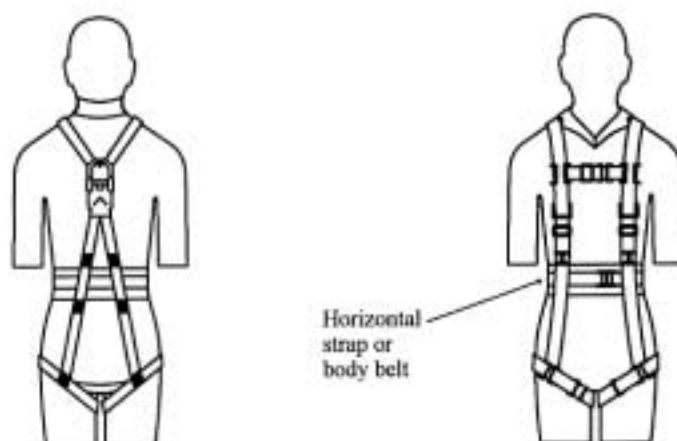


Figure 15 Full Body Harness with horizontal strap  
(AS/NZS)

### (c) Safety Harness under ANSI A10.14-1991

Under the American National Standard, ANSI A10.14-1991, it is called body harness. It consists of straps that are secured about a user in a manner that distributes the arresting forces over at least the thighs, shoulders and pelvis, with provisions for attaching a lanyard, lifeline or deceleration device.

The waist strap shall be a minimum of 44 mm nominal width and strap ends shall be finished so as to prevent fraying. Figure 16 shows a harness under this standard.

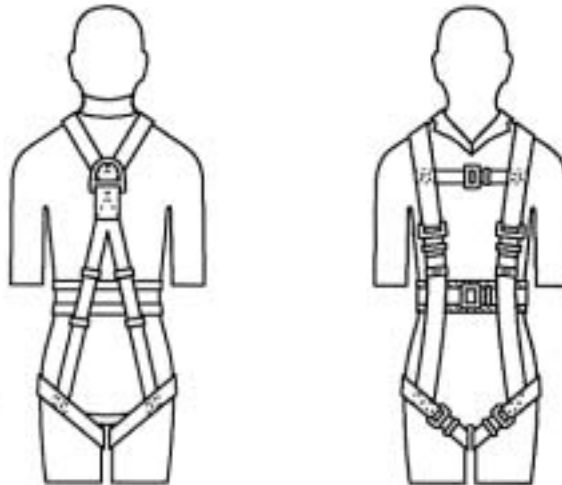


Figure 16 Full Body Harness (ANSI)

The body harness is used for restraint and/or fall arrest and where vertical free fall hazards exist, to reduce the probability of falls or known as Type I equipment. During a performance test, the angle at rest measured between the torso vertical center line and the vertical shall not exceed 30 degrees after the test torso comes to rest.

When more than one attachment element exists on a harness, such as D-rings, the purpose and limitations of each element shall be designated by the manufacturer.

The harness shall carry the following information, either indelibly print or stamp, onto the device or a tag securely attached on the harness :-

- (i) Manufacturer Name or Trade mark
- (ii) Model Number
- (iii) Date of Manufacture

**(d) Safety Harness under GB 6059-85**

Under the People's Republic of China National Standard, GB 6095-85, there are three types of full body harnesses. They have similar shape of shoulder straps but with different forms of lanyards and thing/leg straps. The width of the waist strap shall be between 40mm and 50mm.

The shapes of these full body harnesses are shown in Figure 17, 18 & 19.

The best performance, packing details and instructions for use are specified in the standard.

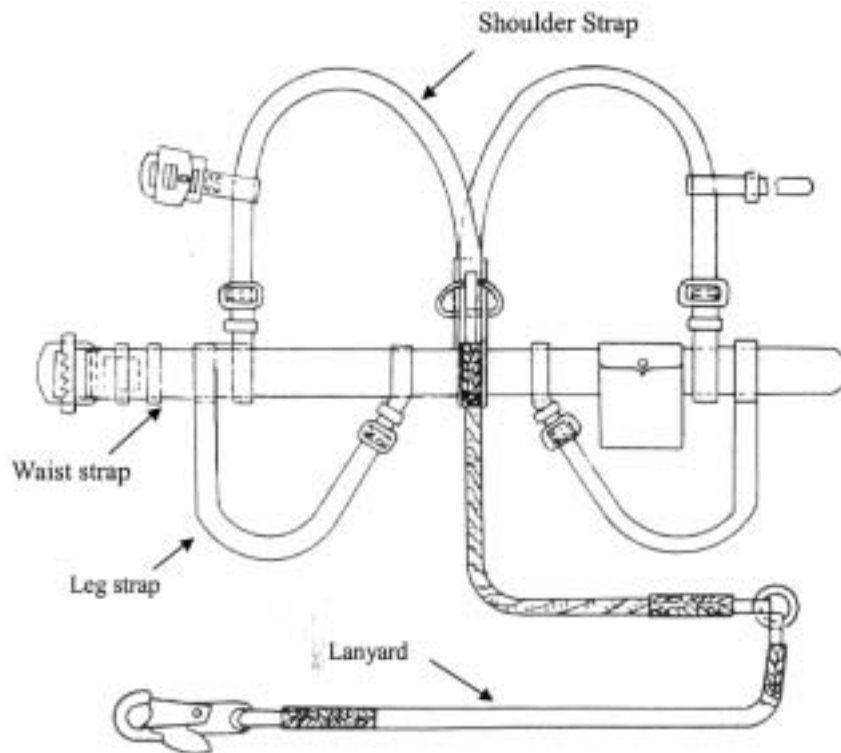


Figure 17 T<sub>2</sub>XB Full Body Harness (GB)

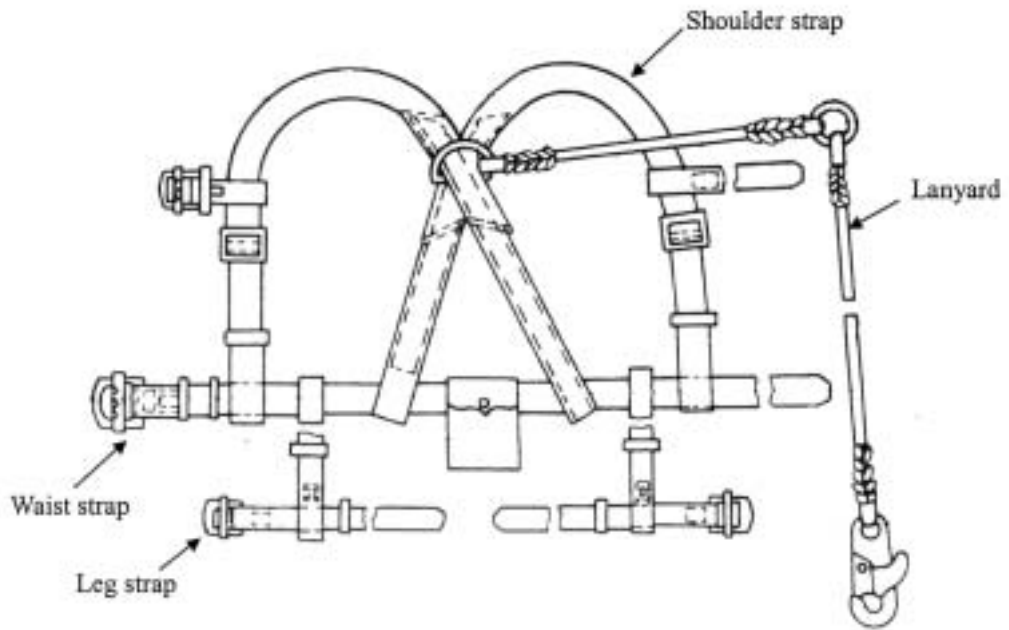


Figure 18 T<sub>3</sub>XB Full Body Harness (GB)

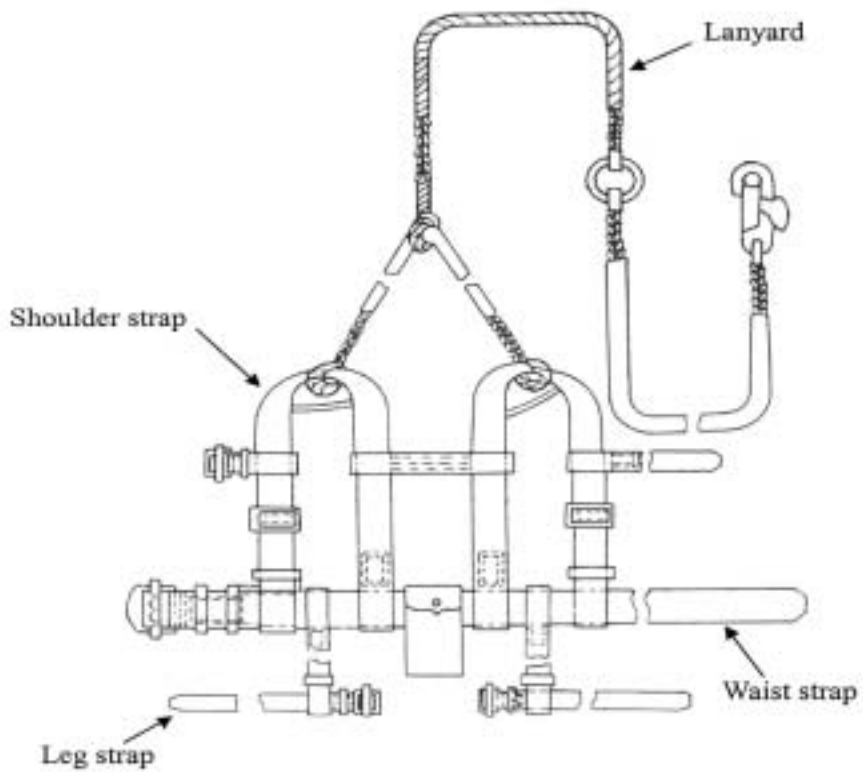


Figure 19 T<sub>4</sub>XB Full Body Harness (GB)

(e) Harness Safety Belts from Japan

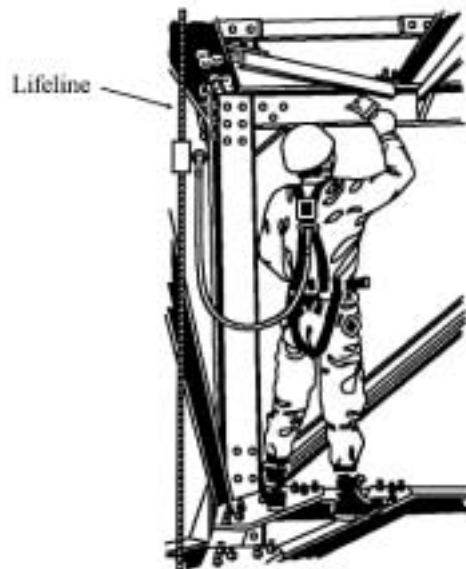


Figure 20 Full Body Harness (Japan)

In Japan, safety harness is called harness safety belt. Its design and mechanical strength have to conform to the test requirements of the Safety Belt Standard of Japan's Ministry of Labour. The harness is designed to protect worker working at height against free fall. The drop impact, should a fall occur, is minimised by distributing the force over the shoulder, chest, back, waist, thighs and buttocks of the body. The typical width of nylon belt is 50 mm, with a lanyard which is 14 mm in diameter and 2.0 m long. The lanyard can be connected to the D-ring on the back or the waist. Figure 20 shows a typical harness from Japan.

Semi-Harness or Chest Harness

(a) Chest Harness from Japan

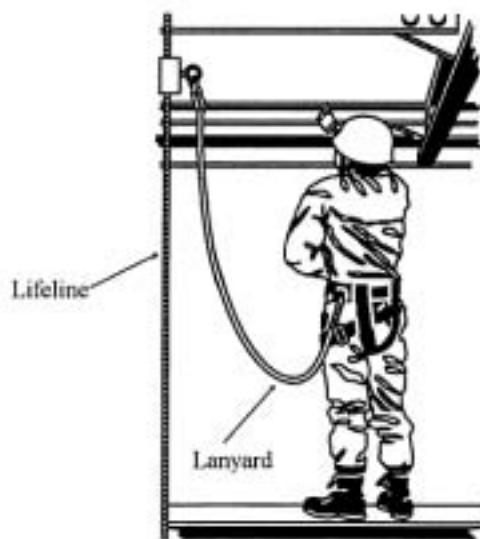


Figure 21 Semi-Harness

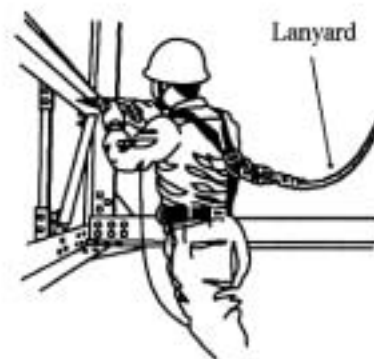


Figure 22 Chest Harness

In Japan, the chest harness is called semi-harness safety belt. There are two types of semi-harness safety belts : semi-harness safety belt with thigh straps and semi-harness safety belt with shoulder strap. Its mechanical property conforms to the test requirements of the Safety Belt Standard of Japan's Ministry of Labour.

Semi-harness safety belt with thigh straps is suitable to use at construction sites, tanks and manholes. Figure 21 shows a harness with thigh strap.

The body is supported mainly by the thighs which permits working at ease. The shock or impact of a fall, should it occur, can be distributed over the waist, thighs and buttock to minimize the effects against this limited area of the body. The waist strap is 50 mm wide, with a lanyard which is 2.0 m long.

Semi-harness safety belt with shoulder strap is for use in work at construction sites, shipyards, mines and steel construction work. The load is distributed to the upper half of the worker's body such as shoulder, back and waist, so the user can work at ease. The waist strap is also 50 mm wide with a 2.0 m lanyard. Figure 22 shows the shape of such a harness.

**(b) Chest Harness under ANSI A10.14-1991**

Under the American National Standard, chest harness is an equipment which is used for restraint but is not for use where any vertical free fall hazard exists or known as Type II equipment. It consists of straps secured only around the chest with shoulder straps to assure proper chest strap positioning. The waist strap should be at least 44 mm width. When it works with a lanyard and an anchor, it is to keep the user at the work level or limit any free fall to a maximum of 0.6 m from the work level. The harness shall be marked 'Type II', either indelibly printed or stamped onto the device or a securely attached tag.

(c) Scaffolding Safety Belt under GB 6095-85

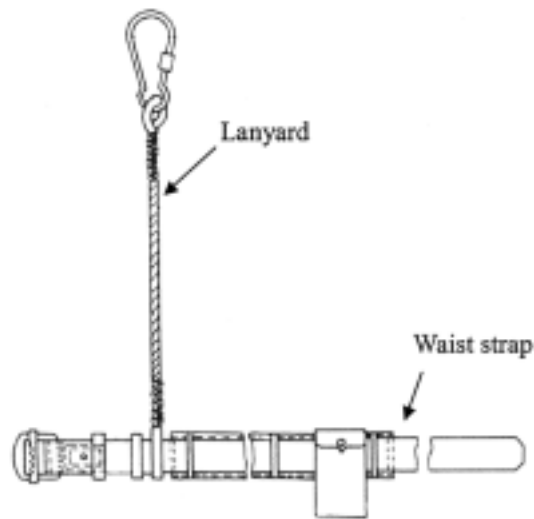


Figure 23 J<sub>1</sub>XY Scaffolding Safety Belt (GB)

There are two types of scaffolding safety belts under the People's Republic of China National Standard GB 6095-85. They have similar waist straps but with different forms of lanyards. The shapes of these two types of safety belts are shown in Figures 23 & 24.

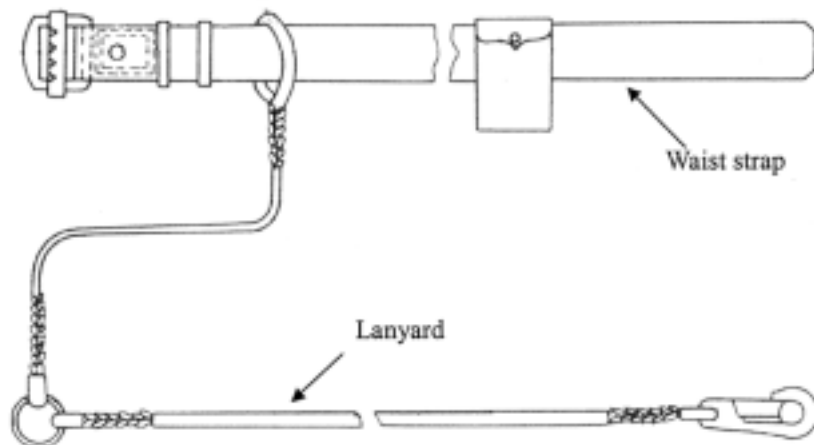


Figure 24 J<sub>2</sub>XY Scaffolding Safety Belt (GB)

**General Purpose Safety Belt**

**(a) 'Body Belt' under ANSI A10.14-1991**

The general purpose safety belt is called 'Body Belt' in the American National Standard for construction and demolition. It composes of a 44 mm strap that both secures around the waist and attaches to a lanyard, lifeline or deceleration device.

'Body Belt' is used for restraint and/or fall arrest where vertical free fall hazards exists, and reduce the probability of falls. When it works with a lanyard, it shall limit the fall to 1.5 m or less.

It is worthy to note that after December 31, 1997, 'Body Belts' is acceptable by the OSHA as part of positioning devices as studies have proven that 'Body Belts' can cause back injury, internal injuries and create the possibility of the user falling out of the belt.

**(b) Industrial Safety Belt under JIS M7624**

Under the Japanese Industrial Standard (JIS), the safety belts for miners are safety belts of body-bind type used to prevent a worker from a free fall while he is performing works on a height or sharp slope such as mining, quarrying or civil engineering works. It consists of a body-bind belt of not less than 50 mm in width, a buckle with anti-corrosion treatment, a lanyard of less than 1.5 m excluding the hook, one or two D-rings, a hook, a carabines or a grip. The belt can carry an auxiliary belt which is more than 75 mm in width for reinforcing twisted or chinked portions of the body-bind belt coupled with it.

The belt can be fitted with a longer lanyard. Even when it is necessary to use a longer lanyard due to the nature

of work, the length shall be limited to 2.5m. Under this standard, the belt without auxiliary belt is classified as Class 1A, and the belt fitted with an auxiliary belt is called Class 2A. Both safety belts also meet the requirements of the Safety Belt Standard of Japan's Ministry of Labour and are commonly used in the construction industry in Hong Kong. Figure 25 and Figure 26 shows the configurations of Class 1A & 2A belts.

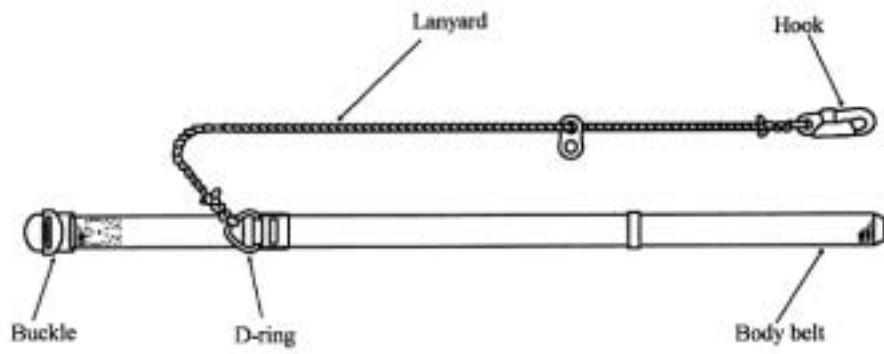


Figure 25 Class 1A General Purpose Safety Belt (JIS)

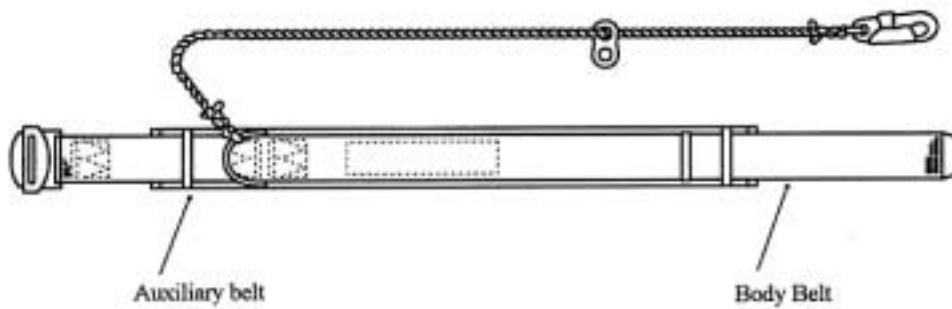


Figure 26 Class 2A General Purpose Safety Belt (JIS)

Work Positioning Belt, Pole or Linesman Safety Belt

(a) Work Positioning Belt under EN 358:2000

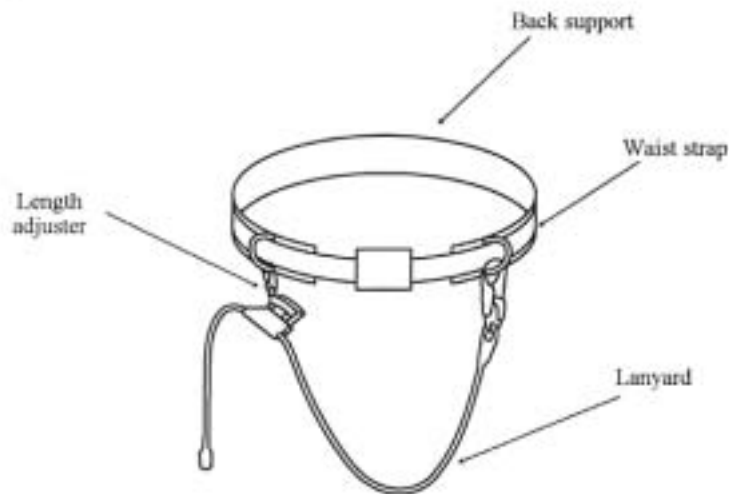


Figure 27 Work Positioning Belt (EN)

The design, construction, static and dynamic strength and test of a work positioning belt are defined in this European Standard, i.e. EN 358:2000. The waist strap shall be not less than 43 mm wide and the back support not less than 100 mm. It can be equipped with adjustable shoulder and sitting straps. The lanyard shall be equipped with a length adjuster and shall have a maximum length of 2 m under all normal circumstances. When purchase, clear instructions for fitting, adjustment and use are supplied with each belt. Markings with the number of standards, name of manufacturer, serial number, year and month of manufacture are available in the product packing. Figure 27 is a work positioning belt.

**(b) Pole Safety Belt under AS/NZS 1891.1:1995**

Under this Australian/New Zealand Standard, work positioning belt is replaced by work positioning harness. The work positioning harness is used in conjunction with a restraint line or pole strap only in situations where there is not a risk of free fall. Where there is a risk of a fall, the harness is used in such a way that under working conditions the pole strap or restraint line is always in tension. The working positioning harness comprises an assembly of an adjustable waist strap or body belt connected to a pair of leg loops by means of front straps, and other straps such as a sitting strap which passes under the pelvis so as to support the lower part of the body in a sitting position, e.g. a 'sit' harness. The harness may include back support or shoulder strap, which may be incorporated within a garment. The harness may be used with a short lanyard in such a way that a free fall of greater than 600mm is not possible.

**(c) Linemen's Safety Belt under JIS T8165-1987**

The design, construction and configuration of a linemen's safety belt are described under Safety Belt Standard by Japan's Ministry of Labour and Japanese Industrial Standard (JIS). There are two types of linemen's safety belts, i.e. single-line suspension and U-shaped suspension. Single-line suspension allows the snaphook to anchor onto the lanyard while U-shaped suspension requires the snaphook to clamp onto the D-ring of the belt. The length of lanyard varies from 2.0 m to 3.5 m. The waist strap is 40 - 50 mm wide and the back support shall not be less than 75 mm in width. The thickness of the strap is not less than 2 mm. Each safety belt is required to be marked on its conspicuous portion the manufacturer's name, the year and month of manufacture. Figure 26 illustrated the two types of belts.

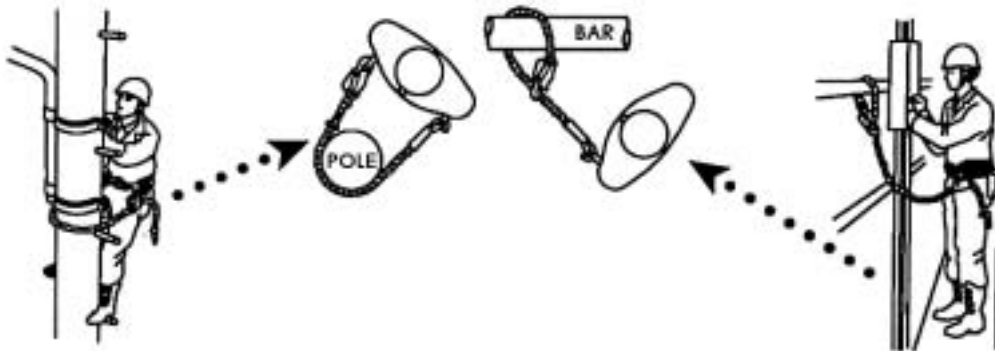


Figure 28 Linemen's Safety Belt (JIS)

**(d) Pole Safety Belt under GB 6095-85**

Under the People's Republic of China National Standard GB 6095-85, there are a number of pole safety belts including general pole safety belts, electrician safety belts and signalman safety belts. Each of these safety belts works with a pole strap wrapping around a pole to support the weight of the worker. They have different forms of waist straps and lanyards. In addition to a waist strap, only one of these safety belt types (DW<sub>1</sub>F Electrician Safety Belt) is provided with a chest strap. Its configuration is shown in Figure 29. An example of pole safety belts without chest strap (DxW<sub>2</sub>Y Signalman Safety Belt) is illustrated in Figure 30.

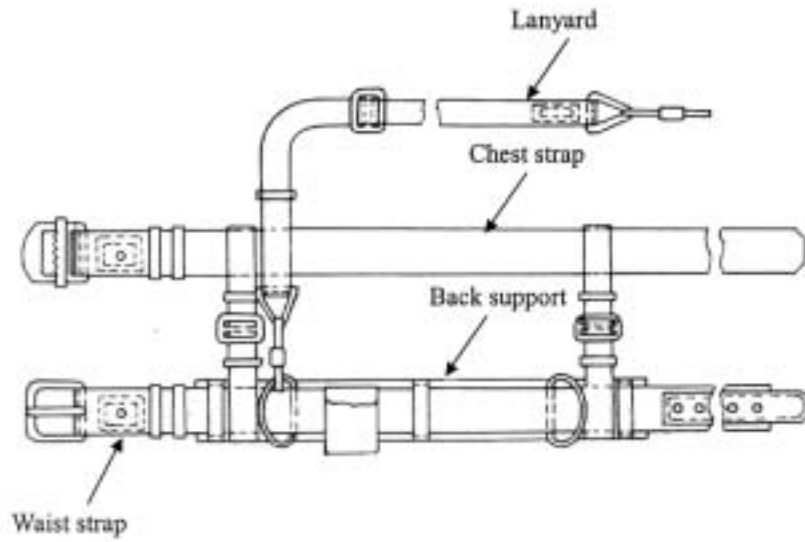


Figure 29 DW<sub>1</sub>F Electrician Safety Belt (GB)

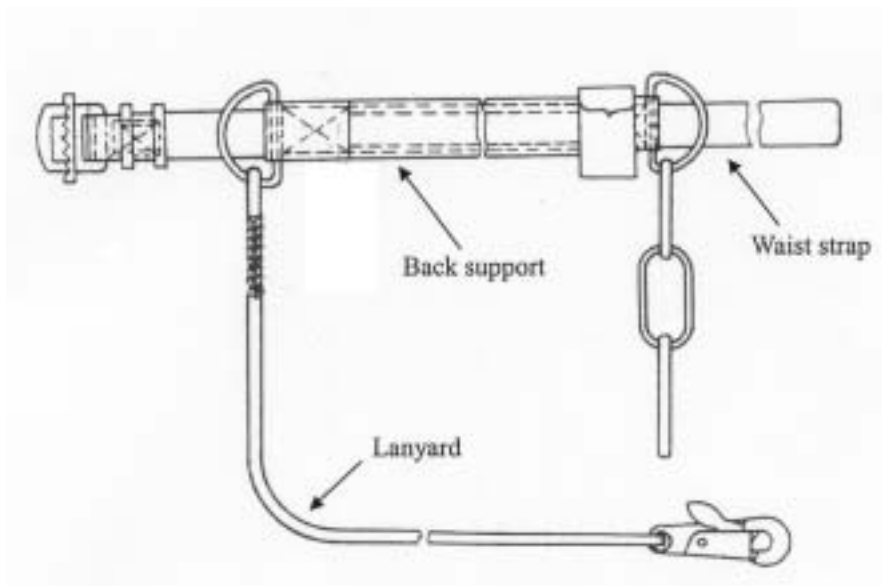


Figure 30 DxW<sub>2</sub>Y Signaller Safety Belt (GB)

## List of Reference

1. European Standard, EN 353-1 and EN 353-2: 2002  
Personal protective equipment against falls from a height : guided type fall arresters.  
  
Part 1: Guided type fall arresters including a rigid anchor line  
  
Part 2: Guided type fall arresters including a flexible anchor line
2. European Standard, EN 360 : 2002  
Personal protective equipment against falls from a height - retractable type fall arresters.
3. European Standard, EN 361:2002  
Personal protective equipment against falls from a height - full body harnesses.
4. European Standard, EN 795 : 1997  
Protection against falls from a height - Anchor devices - Requirements and testing
5. British Standard, BS 1397 : 1979  
Specification for industrial safety belts, harnesses and safety lanyards.  
(Note: this standard was superceded by EN 354, 355, 358, 359, 361, 362, 363, 364, 365 )
6. British Standard, BS 5845 : 1991  
Permanent anchors for industrial safety belts and harnesses  
(Note: this standard was superceded by EN 795 : 1997)
7. British Standard, BS 6858 : 1987  
Specification for manually operated positioning devices and associated anchorage lines for use with industrial safety belts and harnesses.

8. British Standard, BS 7883 : 1997  
Code of practice for Application and use of anchor devices conforming to EN 795
9. American National Standard, ANSI Z359.1 : 1992  
Safety requirements for personal fall arrest systems, subsystems and components.
10. American National Standard, ANSI A10.14 : 1991  
Construction and demolition operations ---  
Requirements for safety belts, harnesses, lanyards and lifelines for construction and demolition use
11. Japanese Industrial Standard, JIS M7624 : 1994  
Safety belts for miners
12. Japanese Industrial Standard, JIS T8165 : 1987  
Safety belts for line-men
13. Ministry of Labour Notification No. 67,  
Safety Belt Standard of Japan's Ministry of Labour,  
September 1975.
14. Australian/New Zealand Standard, AS/NZS1891.1 : 1995  
Industrial fall arrest system and device.  
Part I : Safety belt and harness
15. German Standard, DIN 7470  
Protective equipment against fall --- safety belts,  
safety requirements, testing.
16. 中華人民共和國、國家標準，GB 6095-85  
安全帶

## Useful Information

If you wish to enquire about this Guidance Notes or require advice on occupational safety and health, you can contact the Occupational Safety and Health Branch of the Labour Department through:

Telephone : 2559 2297 (auto-recording after office hours)  
Fax : 2915 1410  
E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation can also be found by visiting our Homepage on the Internet at <http://www.labour.gov.hk>.

Information on the services offered by the Occupational Safety & Health Council can be obtained through their hotline 2739 9000.