

strength or elasticity of materials, and deterioration of materials due to wear or other causes

The primary caution regarding the use of safety belts, as with other personal protective equipment, is to see that they are worn and used correctly. A safety belt is worthless unless it is being worn at the time that a fall is possible. It should also be securely buckled and worn tight enough to prevent any possibility of the man's slipping out of it.

Lifelines

Lifelines should be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5400 pounds.

For most lifelines, manila rope of $\frac{3}{4}$ -in diameter or nylon rope of $\frac{1}{2}$ -in diameter is recommended. Nylon is more resistant to wear or abrasion than is manila and is also more resistant to some chemicals. Ropes made of other synthetic fibers such as Dacron, polyethylene, and polypropylene have characteristics that make them very good performers in certain applications. In a lifeline where shock loading strength and high energy absorption is paramount, nylon is superior.

Knots reduce the strength of all ropes (See Table 26-C). Tests have shown that manila lifelines of $\frac{1}{2}$ -in diameter, when knotted around a bar or other anchorage, are not strong enough at the knots to be safe for general use unless a shock absorber of low load limit is used.

How much a knot reduces strength depends upon the type of knot or hitch used and the amount of moisture in the rope. Moisture increases the strength of a rope in a knot or around a sharp bend, and dryness greatly diminishes its strength at such points. In some cases, a knot will reduce the tensile strength of a rope to less than half of its breaking strength.

If rope is spliced into snaps and D-rings instead of knotted (Fig 19-42), the splice will retain approximately 90 percent of the breaking strength of the rope. Breaking strength is always measured in a straight line pull on the rope. (See Chapter 26, "Ropes, Chains, and Slings.")

Manila rope of $\frac{1}{2}$ -in diameter has a break-

ing strength of approximately 2650 pounds, or (dividing by a safety factor of 5) a safe load strength of 530 pounds. Spun nylon rope of $\frac{1}{2}$ -in diameter is rated to have a breaking strength of 6400 pounds—a safe load strength of 710 pounds.

Manila rope of $\frac{3}{4}$ -in diameter rates a breaking strength of 5400 pounds—a safe load strength of 1080 pounds. When a low-load-limit shock absorber is used, $\frac{3}{4}$ -in manila rope or $\frac{1}{2}$ -in nylon rope is considered strong enough for most lifelines. Without a shock absorber, even $\frac{3}{4}$ -in manila rope may not be strong enough to stop a long fall.

If no shock absorber is available, $\frac{1}{2}$ -in nylon rope is usually preferable to manila rope for impact use, because it stretches more and will act as a partial shock absorber. The chief disadvantage of nylon for this use is that much of its stretch occurs at a very low loading, thus the falling workman can fall a considerable distance closer to some possibly damaging obstruction before an adequate stopping force is exerted by the rope.

Thereafter, the loading increases very rapidly to a rather high force before the final stop. Also, a considerable amount of rebound is obtained from nylon at the higher loadings.

Wire ropes should not be used as lifelines where a free fall is possible unless some shock-absorbing device is also used, because their rigidity greatly magnifies the impact loading. Wire ropes are hazardous when used around electricity.

Lifelines should be tied to permit as little slack as possible, and thus stop a man with the minimum free fall. Special notice must be taken of the nearness of any beam or other obstruction which the workman might strike in case of a fall. Serious injury or death may result if the total free fall plus the total stretch or elongation of the lifeline and shock absorber will allow the workman to strike some damaging object before he is stopped.

If there is a long clear space in which a man may be stopped, then a low-limit shock absorber may be used with less discomfort to the workman. If this space is closely limited, a shorter stop is imperative, even though greater discomfort results.

Wire ropes should be kept clean and dry and should be frequently lubricated. Before