Proper Installation of Rope or Wire Pull Emergency Stop Devices

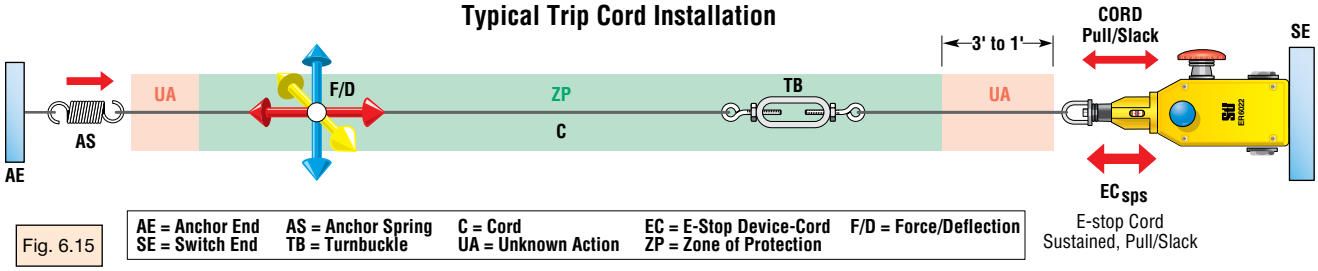
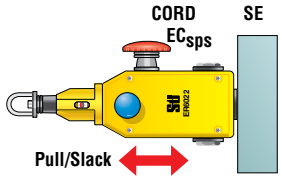
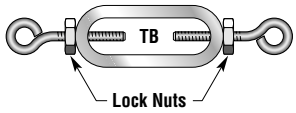


Fig. 6.15

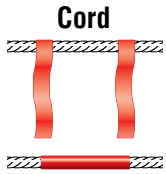
Trip cords (sometimes called rope or wire pulls) are typically cords of braided plastic-coated wire, installed horizontally across the points of hazard generated by rotating machinery, conveyor motion, etc. which, when pulled or cut (made slack) will cause the attached switch to generate an emergency stop. These devices do not prevent injury, but may limit the extent of the injury. They are particularly useful when located at the point of hazard for the involved operator's use, unlike Emergency Stop push-buttons which may be located away from the point of hazard requiring a non-involved operator for their actuation. *Figure 6.40* details a typical installation.



In order to achieve compliance with Canadian and European standards, the rope pull switch must cause its safety contacts to open when either the cord is pulled beyond a designated force/deflection or made to go slack. Further, this activation must be maintained until the cord is once again properly tensioned and manually reset at the switch. When the cable is properly positioned the safety contacts are closed. When the cable moves too far to the left or right, contacts open and are maintained open until reset.



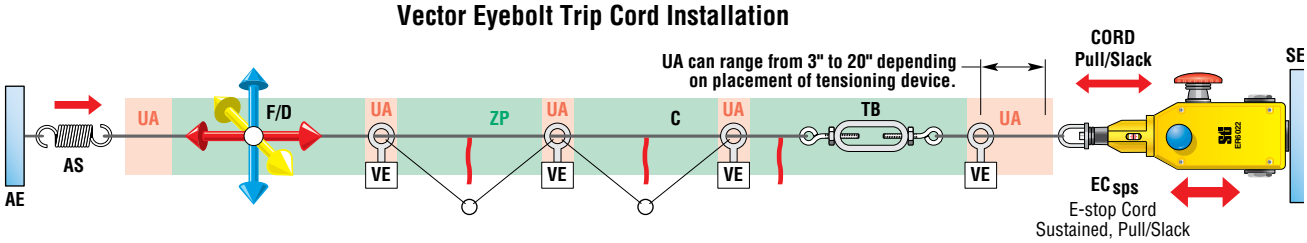
The cable can be properly positioned by adjusting the cord tension using a turnbuckle or other tensioning device. STI rope pull switches provide an indicator to determine when the proper tension has been established. Lock nuts should be provided to keep the turnbuckle from releasing tension and causing nuisance trips.



The cord is typically 1/8 inch diameter steel braided cable which may be plastic coated to protect the operator from steel slivers and provides a better griping surface. The coated cable should be red or provided with red striped flags for rapid identification.

When analyzing the installation for a pull cord, the linear length of cable providing protection must be taken into consideration. As shown in *Figure 6.41* the zone of protection from the anchor end (AE) to the switch end (SE) is not necessarily contiguous; areas of unknown action (UA) may be present. The first of these UA areas is at the point of attachment of the cord to the switch. The switch may or may not operate if the point of force is located less than 1 to 3 feet from the switch. The UA can be reduced to 3 inches if the tensioning device is installed on the opposite side of the vector eyebolt (VE) to the switch. If using a tensioner gripper assembly connected directly to the switch, the UA may be reduced to less than 20 inches.

Vector Eyebolt Trip Cord Installation

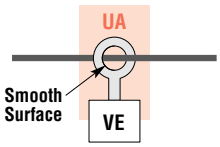


AE = Anchor End | AS = Anchor Spring | C = Cord | EC = E-Stop Device-Cord | F/D = Force/Deflection
SE = Switch End | TB = Turnbuckle | UA = Unknown Action | ZP = Zone of Protection

Fig. 6.16

The vector eyebolt is used to resolve a 3-dimensional force for use with a 1-dimensional switch. The unknown action zone for a smooth eyebolt is about 1". All eyebolts should have a smooth inner surface (not notched or detented). The distance placed between vector eyebolts is typically 6 to 10 feet. A long zone of protection will be made up of many such spans.

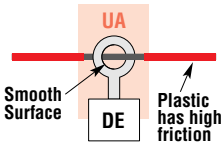
Vector Eyebolt



Some trip cords can operate over 410 feet.

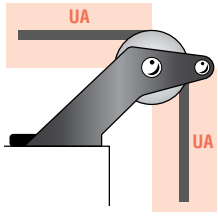
A direction eyebolt is used to change the path of the zone of protection for angles ≤90°. This eyebolt also resolves a 3-dimensional force to 1-dimension. All eyebolts must have a smooth inside surface (not notched or detented). If braided metal cable which is plastic coated (recommended) is used with direction eyebolts, the plastic may have to be removed from the cable where it passes through the eyebolt as this may be a high friction point.

Direction Eyebolt



A directional pulley is a 2-dimensional device. If the force applied by the cable is other than axial to the pulley an unknown action zone may be created, if the entrance and egress of the pulley are not rounded. In extreme friction cases a vector eyebolt may have to precede both sides of the direction pulley. The pulley should rigidly mounted (not swiveled) to avoid friction from side torque. Gritty, goopy, and coating substances should be avoided as they tend to impede pulley action. Open pulleys are not acceptable unless provided with vector eyebolts as non-axial pulls can force the cord from the pulley.

Direction Pulley



When a trip cord is properly installed, the answer to the following question will be yes. Does the switch activate with reasonable force (5 to 20 lbs.) and reasonable deflection (3 to 6 inches) over the zone of protection?

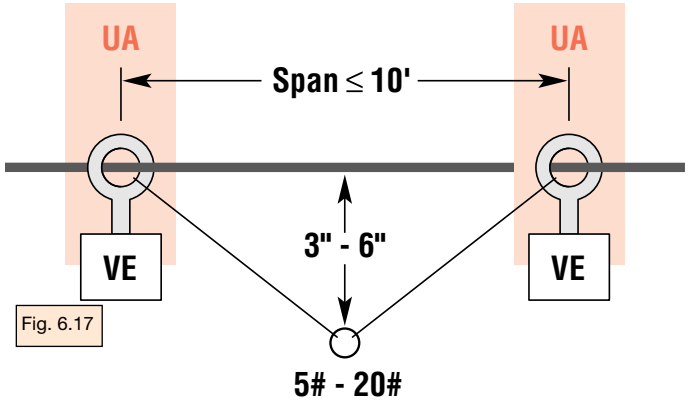


Fig. 6.17

Turning The Corner

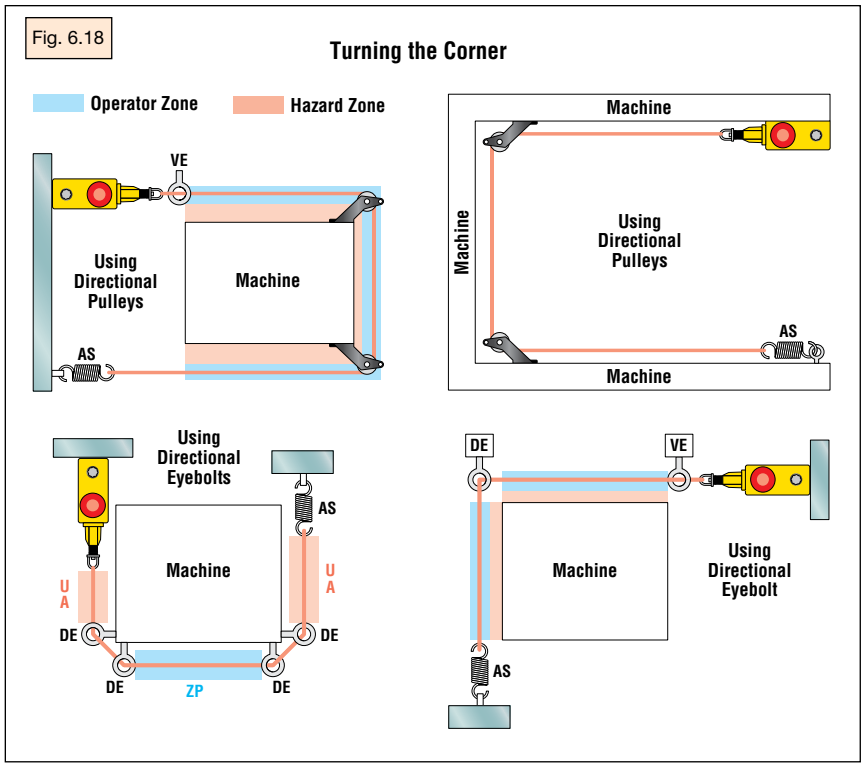
Because of the high tension in a properly installed cord, direction eyebolts and pulleys are subject to additional friction (eyebolts more than pulleys). In general, only one 90° change in direction can be made with an eyebolt and possibly two 90° changes using pulleys.

Friction may be reduced when using eyebolts to round a corner (make 90° direction change) by mounting a direction eyebolt on both sides of the corner as shown in *Figure 6.43*.

Zones of Unknown Action (UA)

Normally zones of unknown action are small with respect to the zones of protection and there is no particular danger that an operator will pull at a location which may not trip. However, if due to machine architecture, the mounting of the cord between sensor end and anchor end a larger unknown action area is presented to an operator, these UA areas should be guarded from operator access as they become additional points of hazard.

Fig. 6.18



STI Rope Pull Emergency Stop Switches

STI rope pull emergency stop switches meet CE mark requirements for use within the European community. All rope pull emergency stop switches are UL or cULus listed. In order to meet the control reliability standards, a safety monitoring relay or equivalent circuitry may be required.

Reset Button
The blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope.

Indicator Beacon
The indicator beacon can be wired to flash red to indicate a tripped switch or glow a constant green to indicate a properly reset switch.

Tension Indicator
The tension indicator makes the system easy to set up and to easy to maintain the proper rope tension.

Emergency Stop Button
The emergency push button may be installed or repositioned in the field.