Proper Use of Tools and Equipment

All tools must be examined regularly to ensure that they are in safe working condition. Cabling installation involves a variety of tools and equipment that prevent safety risks. To help prevent accidents, manufacturers require users to be certified for use of certain tools (e.g., powder-actuated tools). However, even a simple tool can present a safety risk. For example, hand tools must be checked to ensure that wooden or plastic handles are free of splinters, sharp-edged cuts, or other surface damage that could injure an installer's hand.

IMPORTANT: Carefully follow the manufacturer's instructions when mounting, securing, and using potentially dangerous mechanical equipment for cable pulling (e.g., tuggers, cable wheels, cable brakes). Do not set up or operate this equipment without first receiving adequate training.

Protective Clothing and Equipment

Personal protective equipment (PPE) decreases the installer's risk of injury when used properly. This equipment includes:

- Headgear (e.g., hard hat) to protect against falling or flying objects, electric shock, and striking the head.
- Eye protection (e.g., full-face shield, goggles, safety glasses) when working with batteries, powder-actuated tools, and optical fibers. Eye protection is necessary when working in a crawl space, above a dropped ceiling, or above eye level.
- Breathing protection (e.g., respirator, filter mask) when harmful dust, gas, smoke, chemical vapor, or other pollutants are present at the work site.
- Protective footwear on work sites where feet could be injured by falling objects, rolling carts, or stepping on sharp objects. Wear rubber-soled shoes when working near electrical power cabling and equipment. Some work sites do not allow the use of steel-toe shoes. The installer must be aware of any such requirements.
- Protective gloves when performing any work that has the potential for hand or forearm injuries.
- Hearing protection while working in the vicinity of loud noises.
- Well-fitting clothing to protect from minor cuts and materials that could irritate the skin (e.g., fiberglass). Do not wear loose clothing that could get caught on tools, surroundings, or operating machinery.

Identification of Potential Hazards

Installing cable can be hazardous and requires extra safety precautions. The cabling installation team should identify potentially hazardous areas before beginning work.

Inside buildings, electrical wires and electrical equipment are probably the most common environmental hazards faced by the installer. Other sources of potential hazards include dust and debris when working in floor and ceiling systems, exposure of optical fibers to the skin and eyes, asbestos, chemical hazards, and fall and trip hazards.

Treat all electrical circuits as if they are live (energized) even after the circuits have been turned off. Cable pullers must be especially careful in situations where electrical circuits or equipment may be contacted blindly as when fishing conduits in a wall. Do not use metal fish tape in a conduit if the exit point is unverified.

Firestopping

Building codes and standards provide strict requirements for sealing, or firestopping, penetrations through fire- and smoke-rated walls, floors, partitions, and ceilings. Approved methods and materials must be used to reduce the chance of spreading fire, smoke, and toxic gases throughout a building.

All firestopping solutions are a combination of firestop materials, holding devices, packing materials, and other devices that make up a listed system. Use only listed assemblies to properly restore the penetration of any fire- or smoke-rated barrier.

Review project specifications for project approved listed assembly manufacturers and types of assemblies.

Contact an appropriate firestop manufacturer for any situations that are not specifically addressed by the manufacturer's listed methods.

NOTE: See Chapter 7: Firestopping Practices for additional information.

Administration and Closeout Duties

Every cabling installation has several tasks that should be done after the cable is pulled. The installer must:

- Label all ICT components.
- Update the building floor plans.
- Perform housekeeping items.

Before pulling the cable, a temporary label should be placed on each end that conforms to the labeling scheme to be used on the project. The label should identify the cables so that installers will be able to identify them for termination. When pulling multiple cables from different sources at the same time, placing a temporary label of the specific cable identification on the source box or reel will assist in accurate labeling of each end.

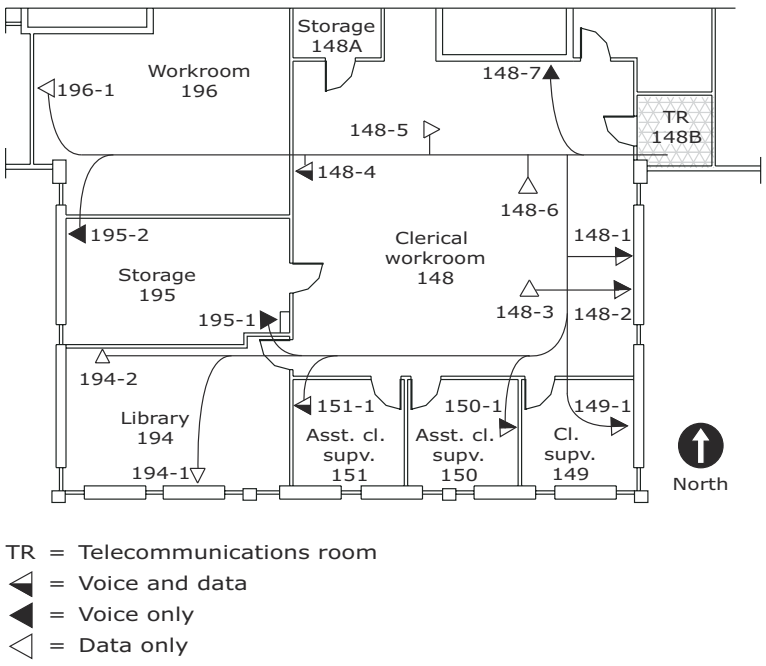
Labels shall be placed so that they are easily readable with minimal disturbance to the cables. These temporary labels will later be removed and replaced with permanent machine-generated labels on all cables, faceplates, and patch panels.

The building plans or drawings are the record of what is in the building. After an installation is complete, the cabling contractor must usually submit as-built plans, sometimes called record drawings, to the general contractor, ICT consultant, or building owner. These plans are a lasting record of cable information that documents the placing of cables (see Figure 5.1).

On the building floor plans, the installer must provide the following cable information:

- Types of installed cables.
- The origination and termination point of each cable.
- Pathway used (e.g., conduit, cable tray).
- Other information as required in the project specifications closeout submittals.

Figure 5.1
Example of marked job floor plans with common symbols



Administration and Closeout Duties, continued

Work areas should be left in the same or better condition than when work began. Several cleanup tasks should be performed in each area of the work site after the cable is pulled. Keeping a work site clean:

- Prevents development of safety hazards.
- Reflects on the professionalism of the installer and the cabling installation company.

General housekeeping items include:

- Picking up used pull strings and pull ropes immediately after use.
- Removing all nonplenum-rated items used in plenum spaces (e.g., cable ties, pull string).
- Disposing of removed sheath and wire scrap.
- Storing cable reels and boxes when the pulling function is complete.
- Vacuuming residue from cutouts in framed walls.
- Vacuuming all dust from fiber distribution units.
- Disposing of all personal items (e.g., food, utensils, coffee cups) and used cleaning supplies.
- Storing tools, equipment, and unused materials properly at the end of the workday.

Pulling Cabling

Overview

Through project planning tasks, the installer has already identified the type of cable, supporting structures, locations, and pulling tools and methods required for the job. Once on site, additional preparation tasks help to organize the work and provide an efficient and safe installation.

Before the job of pulling cable begins, everything should be in its proper place. All materials and equipment must be in place so that the cables can be handled properly. This includes any specialized equipment capable of holding large reels, if required.

Smaller equipment (e.g., cable trees) may be brought in to handle numerous rolls containing low pair-count cable. If all preparations are made correctly, time will be saved once the cable pulling begins.

Cable installation setup tasks include:

- Securing the area.
- Posting floor plan drawings in the area.
- Setting up the appropriate cabling installation system components.
- Selecting and identifying the cable labeling system to be used.

The following information should be listed in the project specifications or obtained from the owner:

- Identifying pull points, transition points (TPs), and pull angles.
- Identifying and establishing group pulls.
- Setting up and placing the pull strings.
- Setting up and securing the cable reels or boxes.
- Identifying telecommunications enclsoure (TE) locations.

Cabling installation procedures detail a series of steps that are repeated for each pulling operation that provide the installer a controlled and consistent method for securing, supporting, and moving reels or boxes of cable; accurate labeling; maintaining bend radius and tensile pressure limits; eliminating spiraling, twisting, and kinks in the cable; verifying cable lengths on each pull; and allowing for sorting and staging cables after they have been pulled into the pathway.

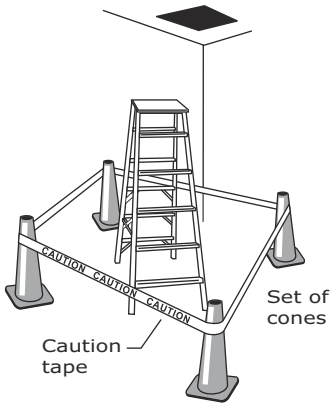
These cabling installation procedures and components should allow all installers to perform each specific task of the installation using the same methods. The methods used will not vary from crew to crew, consistency and controls will be maintained, and best practices will be enforced.

NOTE: Cabling installation components include cable trees or reel supporting devices, labeling systems, pulling harnesses, swivels, pathway rollers and pulleys, and cable sorting and staging organizers.

Steps—Pulling Cable Setup

Step	Pulling Cable Setup
1	Secure the area (see Figure 5.2). • Set up cones, signs, barricades, and caution tape in the work area to alert everyone of danger in the area. • Place caution tape across the entrance of the work area to restrict access by unauthorized personnel. • Notify appropriate personnel that the work is beginning.

Figure 5.2
Area secured with safety cones and caution tape



2	Post floor plans in a conspicuous location prior to the start of cable pulling. The plans provide a record of the pathways and media being installed. As work is completed, the installer should note the type of cable installed, its proposed usage, and if a specific cable color was installed for a specific application or part of the administration scheme (e.g., blue is voice; yellow is data; red is security or is the left outlet in the faceplate; white is the right outlet). After the cabling installation is complete, the building owner will have the reference documents to refer to for future work. It is a lasting record of cable information that documents the placement of cables and may be used to prepare as-built drawings for the project, if required.
3	Set up pull string or pull rope. If no pull string or pull rope exists and is required in the conduit system, one must be installed.

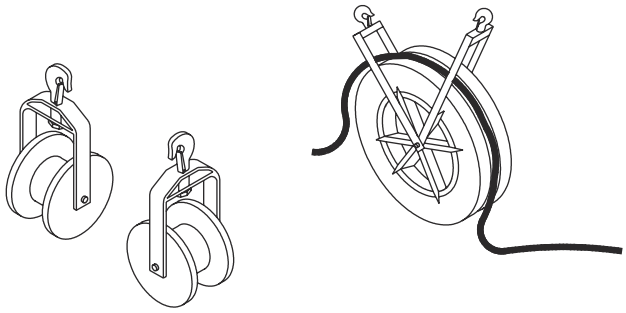
Steps—Pulling Cable Setup, continued

Step	Pulling Cable Setup
4	Identify pull points for each horizontal cable run. • Determine the distance of the complete cable run. Ensure that the distance does not exceed ≈90 m (295 ft). Take care to identify the changes in direction, vertically or horizontally. These changes in direction may cause the run to exceed the ≈90 m (295 ft) limit. • Cables should always be installed parallel or perpendicular to major building structures. Do not run diagonally across a room. There are two fundamental methods of pulling horizontal cable between the telecommunications space and the work areas: • Pulling from the telecommunications space out to the work area: – Allows all of the cable reels and boxes to be staged at the telecommunications space. – If multiple locations will be pulled at the same time, shorter runs will have to be staggered back as they are attached to the cable pulling bundle to minimize waste. This will require measuring at the work area to determine appropriate lengths to stagger the cables. • When pulling from the work area to the telecommunications space: – Cable reels and boxes will have to be relocated to the next outlet location after each pull. – Cable cannot be staged in one location adjacent to where cable is being pulled from. • Cable waste can be minimized by measuring how much slack to back-feed into the telecommunications space (will always be the same length). There will be no waste at the work area since the cables will be cut off the reel and box to the precise length after the pull.

Steps—Pulling Cable Setup, continued

Step	Pulling Cable Setup
4 cont.	• Take notice of the number and locations of bends, and identify where to feed the cable around sharp bends or turns. Pulley hangers may be used at some changes in direction or elevation to reduce the need for additional personnel (see Figure 5.3). Always use correct size pulleys to maintain minimum bend radius.

Figure 5.3
Bullwheel and pulley hangers



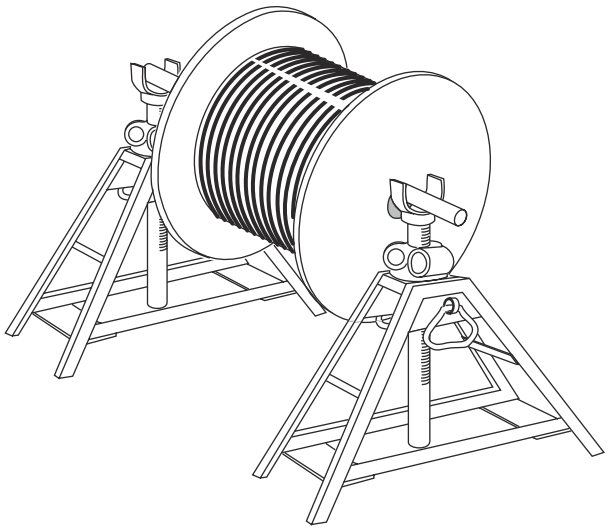
- Allow no more than two 90-degree bends per ≈30 m (100 ft) pull if in conduit.
- Identify one or more intermediate pull points, where necessary, for accessing and handling the cable.
- Where possible, minimize the number of pull points because each pull point requires an additional person, pulley, or a separate pull. A pull point is often encountered when going around any obstacle that could damage cables (e.g., corner in a hallway, around an exposed all-threaded-rod that is supporting the pathway).
- When coworkers are not available to be at all the pull points, one of the most common methods is to pull the cable to the farthest manned pull point, have someone walk the cables down to the work area locations to ensure that enough cable length has been pulled, and then walk the cables back to the last manned pull point. This creates a long loop of cables on the floor as the cable ends are now fed back up into the ceiling as everyone relocates to new pull points to receive the cables being fed to them.

  NOTE: In some situations, it will not be possible to pull the entire cable run at one time (e.g., busy hallways, a patient care area in a health care facility where cable may have to be pulled in sections to minimize the amount of open ceiling tiles and the size of the short duration barriers that may have to be erected). When being restricted to a certain area, the cable may have to be pulled to the farthest manned pull point and then placed in a figure eight on the floor, ensuring that there is enough cable to reach the work area locations. To continue the pull, workers are relocated to the next vacant pull points until the cable pull is complete.

Steps—Pulling Cable Setup, continued

Step	Pulling Cable Setup
5	For most large cable reels, use the appropriate cabling installation system. In some cases, it may be necessary to set up a pair of jack stands, reel dolly, or set of cable rollers (see Figure 5.4). A reel dolly is basically a jack stand with wheels that allows easy relocation of the assembly. A set of cable rollers consists of two shallow metal troughs, each containing two small rollers. The reel can be rolled on top of the small rollers. • The size of the cable reel and the combined weight of the cable reel and cable may not allow the use of cable rollers and require the use of a jack stand or reel dolly to support the reel. NOTE: Many contractors use jack stands for holding the reels of cable off the floor. This equipment sometimes is made from homemade supports, and a pipe is used to appropriately suspend the reels.

Figure 5.4
Large reel and adjustable jack stands



IMPORTANT: Take appropriate precautions to ensure that the cable reel cannot be dislodged from the jack stands, reel dolly, or cable rollers or tip over and become a hazard to personnel and items in the area, or set up a clear area in the vicinity with appropriate warning and barrier items to minimize the hazard of a dislodged reel.

- Select a location that is large enough for the number of spools needed.
- Set up the jack stand inside the TR if there is space for it, or set it up in the area just outside the TR.
- When a TE is used, the designated work area must be set up so that it will not impede other trades.

Steps—Pulling Cable Setup, continued

Step	Pulling Cable Setup
6	Place a pipe or crossbar (known as a spindle) through the center hole in the reel. IMPORTANT: Use a sufficient number of personnel, or use suitable mechanical lifting devices when lifting reels into jack stands to avoid personal injury. Jack stands used for placing larger cables usually have a mechanical ratcheting or hydraulic lift mechanism to assist in lifting the reels into place for pulling. Ensure that the spindle can support the weight of the cable reels. NOTE: In some pulling operations, reel or cable brakes may be needed to control the payout of the cable.
7	Prepare the cable bundle. Balanced twisted-pair cable is shipped in several different containers: • Payout box • Reel-in-a-box • Reel NOTE: Cable reels can be ordered with various put-up lengths. Boxes of copper twisted-pair cable are usually ≈305 m (1000 ft).
8	For reels and boxes, use the appropriate cable support system to aid in the cable pulling operation. • Temporary cable support devices (e.g., rollers, pulleys, cardboard) are used to transition into the ceiling when there are multiple small cables being pulled at the same time. • When pulling from the telecommunications space out to the work area, set up cable support devices outside the TR in the hallway. This will allow a direct pull down the hallway.