



New Standards Reduce Guy Installation Cost

Automatic connector offers security, safety and re-usability benefits.

By Ray Necochea, San Diego Gas Electric Co.

San Diego Gas Electric Co. (SDGE) commits a lot of resources to the maintenance and repair of overhead lines. In line with management's desire to minimize installed cost, maximize safety and service life and simplify maintenance and repair, we reviewed our operating practices on mechanical guying and developed new standards to improve system performance.

Serving more than 1.1 million customers in San Diego and the surrounding 35 communities, SDGE operates 7337 mi of 13-kV overhead distribution lines and 7239.4 circuit mi of overhead transmission. Of the utility's 4249 employees, 360 are line personnel.

Guying is a daily procedure for our crews, so an improvement in cost, safety, and service life would have a system-wide, long-term impact. Nine sizes of guy wire are used across the system, depending on installation type and location. Table 1 shows our standards for seven sizes of guy wire from 1/4 to 7/16 inch.

At the beginning of our investigation, the standard practice was to use a strain insulator (Johnny Ball) at the top of the guy to isolate the structure. The tensioned guy wire

Nominal Size (Inches)	Number of Strands	Tensile Strength Rating (lb)		
		Common	Utilities	High Strength
1/4	7	1,900	3,150	4,750
5/16	7	3,200	6,000	8,000
3/8	7	4,250	11,500	10,800
7/16	7	7,400	25,000	14,500
1/2	7	7,620	-----	19,100



Fig. 1. Determination of lowest installed cost involved a timed side-by-side installation of the automatic connector (right) and a wire-formed grip.

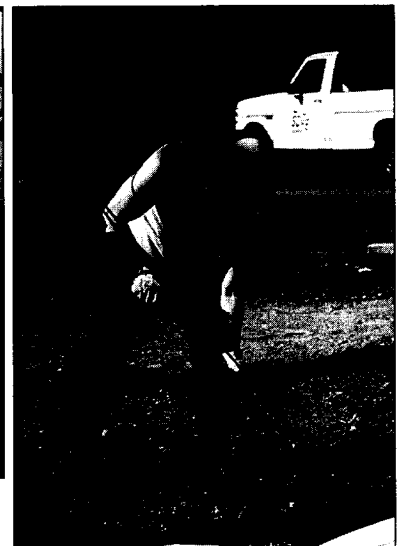


Fig. 2 With the guy pulled to proper tension, inserting the wire in the cartridge was fast and simple. Retensioning is convenient and simple, as well.

was secured top and bottom with a formed wire grip. The process was time consuming and linemen had to wear gloves and long sleeves to prevent cuts and abrasions. Retensioning required removal of the grip, then installation of a new one since the product was not to be re-used. We also encountered instances of vandalism where strands had been loosened, jeopardizing the integrity of the pole.

Developed Testing Program

Many utilities use automatic connectors to secure the tensioned guys' tops and bottoms. Our survey included electric and telephone utility neighbors of our system. As a result of the positive feedback from these other users, we developed a testing program to evaluate the automatics compared to grips in mechanical strength, field installation and installation integrity (Fig. 1).



Fig. 3. The completed installation of the Strandwise is clean and secure, plus vandal resistant. No loose strands protrude for possible pedestrian injury.

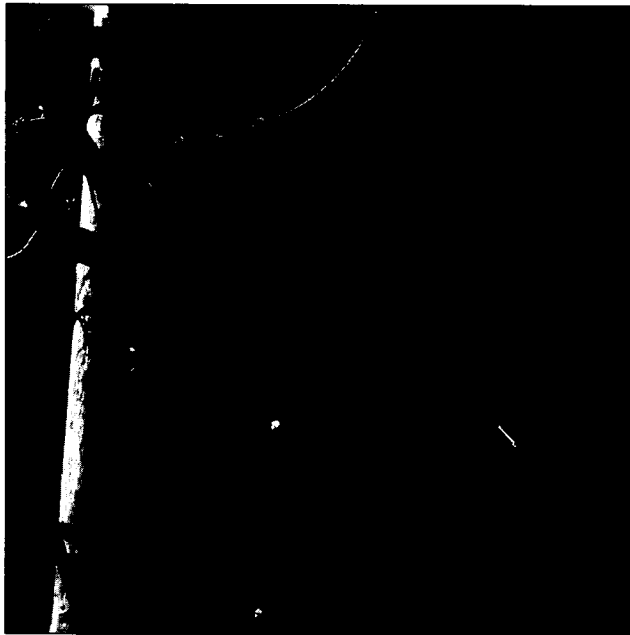


Fig. 4. In an isolated guy installation, the bail feeds through the Johnny Ball easily for a quick and clean installation.

As stated, mechanical guying is a daily activity. In our 3/8-inch size alone, there are an average of 188 installations annually. So, we set out to establish uniform test criteria and performance requirements to evaluate capability in all our districts. The criteria included:

- Mechanical strength: rated and post salt fog exposure.
- Safety: pedestrian, crews, and during catastrophic events.

- Installation time.
- Repair/replacement time and ease.
- Retensioning ease.

Automatic connectors selected for evaluation were Strandwise guy attachment and Strandlink guy splice by Reliable Power Products, Franklin Park, IL. Selected for evaluation were the Strandwise 5102, 5152-6 and 5102-L, and the Strandlink 5002. Their wire size is 3/8 inch galvanized steel, and their rated tensile strength is 9720 lb. The rated strengths were more than sufficient to work with our standard wire tensile strengths. We submitted the samples to 2000 hr of salt fog chamber exposure and had an in-house laboratory test them to destruction. Table 2 presents those results. A quick review showed us that the automatic connectors had the mechanical strength to perform satisfactorily, so we moved on to the field-installation segment of the evaluation.

Table 2: Mechanical Strength Test Results

Hardware	Wire Size	Tensile Value At Failure (lb)
Reliable Strandwise 5102	3/8 Inch Galv. Steel	10,020
Reliable Strandwise 5152-6	3/8 Inch Galv. Steel	10,180
Reliable Strandwise 5102-L	3/8 Inch Galv. Steel	11,330
Reliable Strandlink 5002	3/8 Inch Galv. Steel	9,080

Table 3: Products Selected for Field Testing

Unit	Wire Size (Inches)	Use
Strandwise 5100	1/4	Guy Attachment
Strandlink 5000	1/4	Guy Splice
Strandwise 5101	5/16	Guy Attachment
Strandlink 5001	5/16	Guy Splice
Strandwise 5102	3/8	Guy Attachment
Strandlink 5002	3/8	Guy Splice
Strandwise 5203	7/16	Guy Attachment
Strandlink 5043	7/16	Guy Splice
Strandwise 5204	1/2	Guy Attachment
Strandlink 5404	1/2	Guy Splice

To ensure enough installations to provide representative data, we purchased quantities of five sizes of the automatic connectors as noted in Table 3. We then provided supplies to crews in five districts, training them on proper installation (Figs. 2, 3 4). An evaluation form provided step-by-step instructions for the evaluation and a means to communicate crew feedback. In general, we asked the foremen to provide the following for both products:

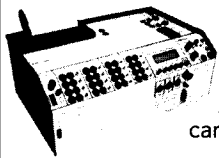
- Installation time.
- Finished appearance evaluation.
- Details on handling, storage and use.
- Crew evaluation.
- Details on retensioning.
- Evaluation of long-term durability and safety.
- Crew feedback on conclusions.

Comparison Formula

To provide a common and realistic basis for installed cost, we established a base formula for quick comparison:

CIRCUIT BREAKER TESTING

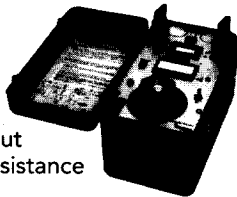
ANALYZERS



TIMING AND TRAVEL-MOTION in a rugged 20" x 18" x 8" carrying case

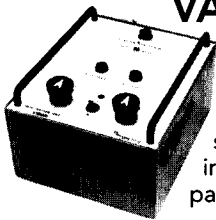
MICROOHMMETERS

200 TO 600 AMP units with automatic digital readout of contact resistance



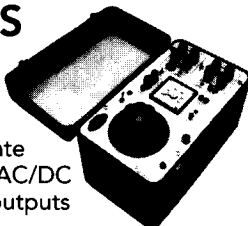
VACUUM TESTERS

GO/NO-GO vacuum bottle switchgear testing in a compact 19 lb. package



POWER SUPPLY UNITS

REDUCED VOLTAGE TESTING with separate 0-250 volt AC/DC trip/close outputs



HIGH CURRENT TEST SETS

ONE-MAN TRANSPORTABLE designs exceeding 5,000 amperes instantaneous



Programma

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Petaluma, CA 94954
707-769-9951

Installed Cost = T/60 min/hr X R X C_p where

T = Installation Time

R = Crew Hourly Rate

C_p = Product Cost

Crews and foremen were unanimous in their praise of installation ease and simplicity, clean uncluttered installation, security, safety, and long-term reliability.

With the feedback in from all districts, the overwhelming preference was for the automatic connector. Crews and foremen were unanimous in their praise of installation ease and simplicity, clean uncluttered installation, security, safety, and long-term reliability. An unexpected side benefit was the reduced storage required on the line trucks, plus the elimination of entangled wires on the grips.

The automatic connectors are packaged in plastic bags, which keep the units clean. The imprint on the bag and connector body shows the application size for quick reference. The package also includes a dust cap in the line end and a pilot cup in the installation end for further protection from the elements. Comments from the crews and foremen included:

"No complaints. Good product, easy to install. Should be a Materials Stores item."

"A real time saver."

"Great product. Makes our job easier and faster."

"The time it takes to install an automatic is probably one fourth or less of the time to install the type we use."

"These automatic grips are so much faster and easier to use, it's unbelievable.."

Installed-Time Comparisons

More to the point of the mission were the time results. The Strandvis-versus-grip installed-time comparisons were dramatic. Over our test period, crews completed the guy installation in less than half the time

with the automatic connector — less than 7 min, compared to more than 15 min for the grip on average. By applying our formula, we realized a significant savings even though the initial cost of the automatic connector is higher. Here are some sample calculations for reader comparison:

Automatic Connector

Cost = 7 min/60 min/hr X Crew Hourly Rate + \$7.20 per unit

Formed Wire Grip

Cost = 15 min/60 min/hr X Crew Hourly Rate + \$4.27 per unit

The time savings is significant because of the work load and the reduced number of crews we now operate. As the focus continues on reducing operating costs, we are working to control our direct and contract labor, making productivity a critical issue.

In addition, the retensioning of the automatic connector was simple and was accomplished quickly. All we had to do was pick up the strain with a come-along, release the jaws according to instructions, retension, feed the wire back through the jaws, and let off the come-along. It was accomplished in minutes.

We also noticed we ended up with a smooth installation package with no sharp edges or loose strands that could injure a pedestrian. From the standpoint of accidental contact with a vehicle, the Strandvis is less likely to fail. This condition was reassuring from a security standpoint.

As a result of the investigation, we revised our standards for all guy installations to require the automatic connector throughout our system. We look forward to enjoying the cost benefits as well as the attendant advantages in security, safety, and re-usability. **T&D**

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