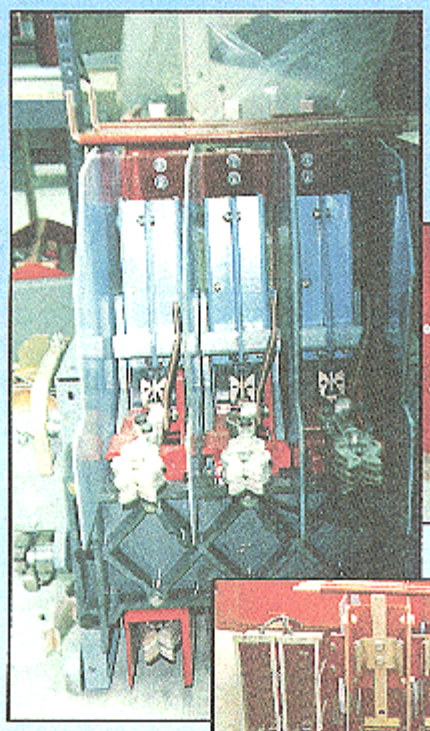
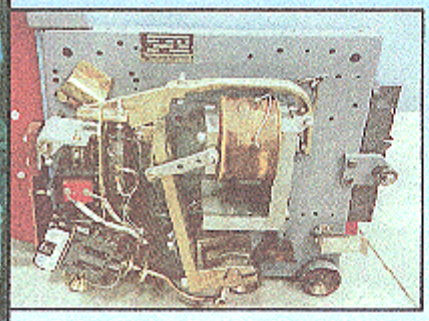
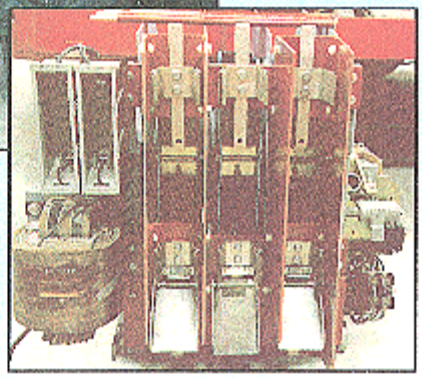
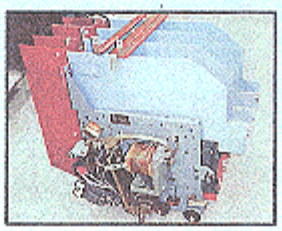
NETA WORLD

The Official Publication of the InterNational Electrical Testing Association $12.50 Fall 1998









Inspecting and Servicing Loadbreak Elbows

by Don Genutis
Hampton Tedder Technical Services

Introduction

The loadbreak elbow is an extremely reliable connector that is often ignored during regular electrical testing and maintenance activities. This article examines the application and construction of these devices along with problems encountered and inspection recommendations for ensuring continued reliable service.

- **VOLTAGE** (Insulation)
  System voltage: 15kV class with maximum
  8.3kV phase to ground/14.4kV phase to phase.
  BIL: 95kV impulse voltage, 1.2 x 50 microsecond wave.
  AC Withstand: 34kV, 60 Hz, 1 minute.
  DC Withstand: 53kV, 15 minutes.
  Corona Extinction Voltage: 11kV
- **CURRENT** (Connection)
  Continuous operation: 200 amps, rms.
  Short-time: 10,000 amps. rms, sym, (0.17 sec.) 1.3 max. asym factor.
- **LOADMAKE/BREAK** (Switching)
  160 & 360 circuits 8.3kV line to ground. 14.4kV max. across the open contacts 10 loadmake/break operations at 200 amps max. with 70 to 80% lagging PF.
- **FAULT CLOSE** (Switching)
  1 fault-close operation at 8.3kV or 14.4kV; 10,000 amps, rms sym, 10 cycles (0.17 sec.) 1.3 max. asym factor applies to new or used mating parts (up to maximum designated switching operations).
- **SHIELD DESIGN** meets the IEEE Standard 592 for Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors.
- **PRODUCTION TESTS** include 100% tests of the premolded products to assure:
  –Corona Extinction Voltage: 11kV min. (tested at 3pC. sensitivity) and either of the following dielectric strength tests:
  –Impulse (BIL): 95kV, 1.2 x 50 microsecond wave.
  –AC Withstand: 34kV, 60Hz, 1 minute.
  –Test Point Voltage Test (where applicable): operation verified.

Figure 1

Application

Loadbreak elbows are the most common member of the molded rubber cable accessory family. These devices were originally introduced in the sixties, primarily for utility applications. Because of their superior reliability, safe operation, and low cost, loadbreak elbows have become very popular at industrial and commercial facilities as well.

Most commonly found in 15 kV class applications, these cable accessories are true loadbreak devices with continuous, short time, switching, and fault close ratings (see Figure 1). Additional advantages to utilizing these products include the capability of isolating a transformer for maintenance without interruption of other loads served from the same primary circuit.

Construction

A typical loadbreak connector is shown in Figure 2. These devices provide for insulation and shielding

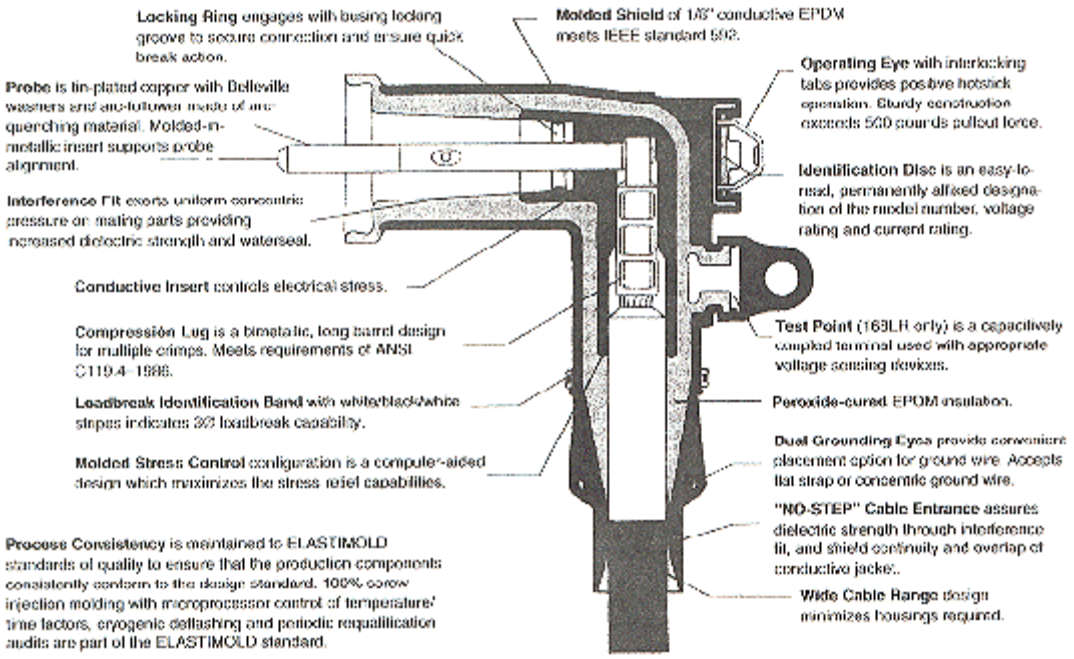


Figure 2

within the molded rubber assembly, designed to reduce voltage stress. The assembly mates with a loadbreak bushing insert (Figure 3) providing the necessary dielectric strength and water seal. The locking ring secures the connection mechanically.

Current is carried through a compression lug that is crimped to the cable conductor and is threaded at the other end to accommodate the probe. The probe is typically constructed of tin-plated copper and a high temperature arc-quenching material.

The outside of the elbow houses the operating eye that is used with an appropriate hotstick for installation or removal. The elbow may also be equipped *with a capacitively coupled test terminal to facilitate* voltage detection. A white/black/white identification band on the outside of the housing, if present, indicates three-phase loadbreak capability.

Installation

Elbow installation is relatively easy and does not require any special equipment or tape products. The cable is prepared in a typical fashion as instructed in the termination kit, and the compression lug is crimped to the cable conductor. The conductor is then inserted into the elbow housing. The probe is threaded into the lug and tightened with the provided cable wrench until the wrench bends, thus applying the correct torque.

The elbow receptacle and the mating bushing must be lubricated with the silicone grease material provided with the kit. This grease prevents the mating surfaces from sticking together and fills air voids to prevent partial discharges from occurring.

Connecting the elbow to the bushing insert should not be done by hand. It should only be performed by utilizing a hotstick attached to the operating eye.

In-Service Problems and Suggested Inspections

The silicone grease that provides lubrication necessary to allow removal of the loadbreak elbow from *the bushing insert will dry out over time. When this* occurs, excessive force may be required for separation. This force may result in personal injury or damage to the connector.

The mechanism by which the silicone grease aging process occurs is illustrated in Figure 4. The grease consists of silicone oil which is thickened through the addition of silica in the form of a fine powder. These components separate during aging, and the oil migrates to other areas of the assembly. Adhesion of the mating surfaces and partial discharge activity may then occur.

Qualified personnel should perform inspections of loadbreak elbow connectors as part of the facility's regular maintenance program.

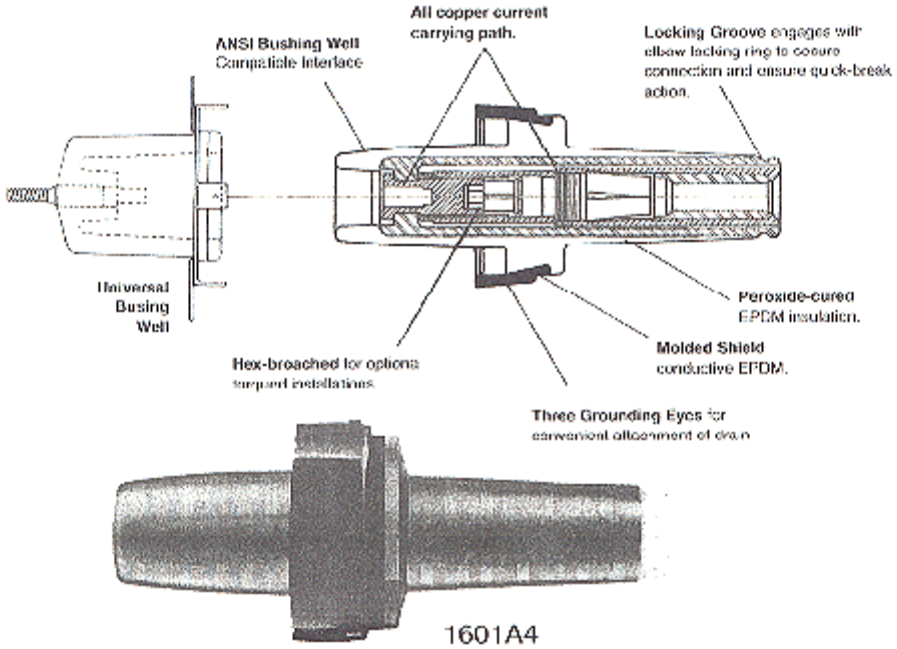


Figure 3

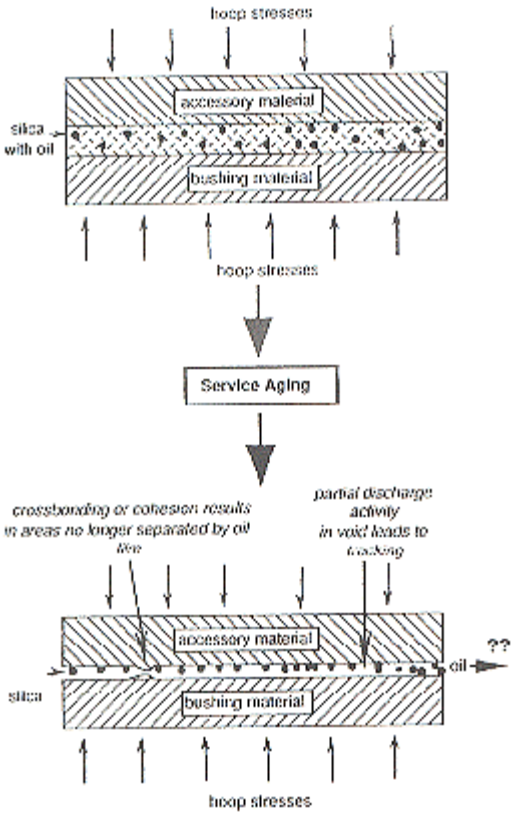


Figure 4 — Outline of Molded Rubber Cable Accessory Adhesion Failure Mechanism

Before disconnecting any devices that have not been serviced recently, the technician should have spare elbow and bushing inserts on hand. If the elbows can be removed without damage they should be inspected for white or yellow film or powder buildup and signs of tracking. If permanent tracking damage is not present the accessories can be cleaned and relubricated and then placed back into service. The loadbreak devices should also be inspected for signs of overheating or brittleness and cracking of the molded rubber assembly. Probe tightness should be checked with the cable wrench, and the probe should be inspected for damage or excessive wear. Marginal connectors should be replaced.

Conclusion

The reliable loadbreak elbow continues to be widely utilized in medium-voltage applications. Performing regular inspections and maintaining lubrication will ensure maximum accessory lifetime.

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Don A. Genutis has recently accepted the position of managing director at Hampton Tedder Technical Services, a NETA Full Member company in Southern California and Las Vegas. He is a NETA Certified Technician III.