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March 10, 1971

SUBJECT: REPRINT ON LEAD CABLE SHEATHING

To Members of the Lead Industries Association, Inc.:

The attached reprint "Lead-Covered Underground Cable Use Increasing" has just been obtained in quantity from TRANSMISSION & DISTRIBUTION. The article is based in total upon a speech given before the 41st LIA Annual Meeting and was presented by Mr. C. N. Peters of Wisconsin Electric Power Co.

This publication will be offered to readers of LEAD MAGAZINE who are interested in in-plant power supply, as well as in response to specific inquiries on lead sheathed cable. If you would like to have up to 25 copies for distribution within your organization, please let me know. These copies are available free of charge as long as they last.

Very truly yours,

Jerome F. Smith

Jerome F. Smith, Manager,
Advertising & Technical Service

JFS:c
Attachment

# Lead-Covered Underground Cable Use Increasing

BY C. N. PETERS
WISCONSIN ELECTRIC POWER CO.

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## More lead-sheathed cables than ever before are being installed on WEPCo lines

BY C. N. PETERS
WISCONSIN ELECTRIC POWER CO.

There has been a steady increase in use of lead-covered cables in the 12- through 35-kv class on WEPCo underground lines since 1965. This is notwithstanding the fact that lead-covered cable installations now represent only some 35 percent of total cable installations in this voltage range during the same period. Popularity of lead-covered cable continues simply because there are areas on our system where its characteristics are preeminent, and nothing yet devised can serve as well. So long as loads continue to grow, installation of lead-covered cables in these areas will increase.

There is a logical separation between areas where the newer cables with synthetic sheaths can be used and those where lead-sheathed cables are more suitable. The industry has been under pressure for a number of years to install new distribution systems underground and, in many instances, to replace overhead facilities with underground. This has become feasible in some areas where improvements in rubber compounds and developments in polyethylene and extrusion equipment have resulted in an economical cable that could be direct-buried in the ground.

Early needs for new underground systems were in residential subdivisions where a single-conductor primary cable with concentric neutral proved adequate. Later, use of three single-conductor, non-leaded cables in the same trench made undergrounding of certain main-line circuits feasible. However, the important item in both cases is that synthetic-sheathed cables have not necessarily become a substitute for lead-covered cable, but rather a replacement for overhead lines.

However, there still remain many metropolitan downtown areas where it is impossible to install overhead lines because of building arrangements. Use of direct-buried cable in these areas is impractical, because of paved streets, sidewalks, and general congestion of all underground facilities.

Currently a manhole-and-conduit system for electrical distribution in downtown city areas is the only answer. Further, many cables of different voltages are required because of the heavy loads in the area, for which lead-sheathed cables are the only types of conductor now available. Consequently, multiduct banks are frequently installed as the best solution.

Conduit-and-manhole systems represent sizable investments requiring efficient utilization. Generally, this dictates use of three-conductor cables, each occupying a single duct, as opposed to installation of three single-conductor cables, possibly requiring two or three ducts, because of their greater overall diameter. Three-conductor, lead-sheathed cables are available for this situation and provide the practical solution. These same considerations apply to large shopping centers, utility distribution substations, and other areas where congestion below ground is a major problem.

The chart of Fig. 1 shows percentages of lead-sheathed cable in the 12- through 15-kv class installed by WEPCo during the years 1959 through 1968. Of particular interest in this curve is the abrupt change in slope starting in 1966 when the sharp decreases of the preceding years slowed down and started to rise. This was in spite of the rapid increase in use of synthetic-sheathed cable during the same period which entered into the percentage base.

Figure 2 shows separately actual cable feet of both types of cable in the 12- through 35-kv voltage class installed during the same period. Here, effects of very large increases of synthetic-sheathed cable installed during the period are separated from installation figures of leaded cables, indicating an upward trend for lead-covered cable installations during the entire period.

Care should be used in evaluating the curves of Fig. 2, for the majority of lead cable installed was three-conductor, while all of the non-lead cable was single-conductor. Applications of the two types

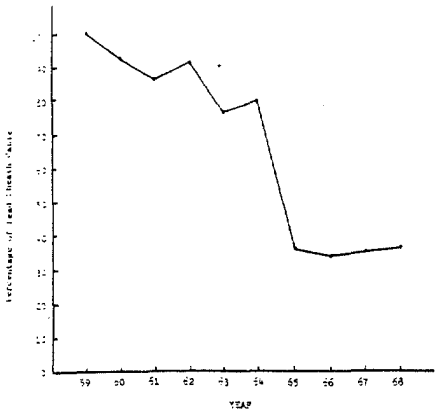


Fig. 1. Percentages are shown of total cable feet of underground cable installed by WEPCo during years indicated represented by lead-sheathed cables. Note upturn in percentage use of leaded cable following 1965.

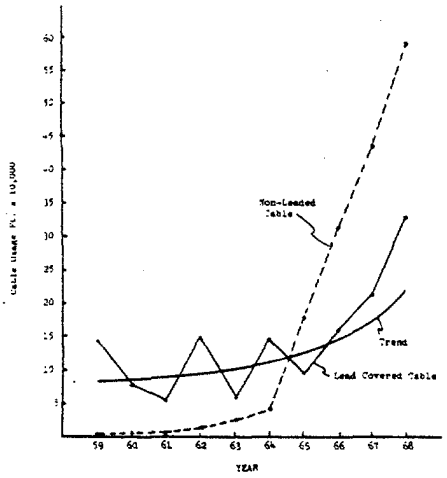


Fig. 2. Increases in annual installations in the 12- through 35-kv voltage class of lead-sheathed cable by WEPCo has been steady in the period shown notwithstanding increasingly heavy installations of non-leaded cable.

of cable are quite different, and the curves show only relative changes for each type of cable with respect to itself.

Probably there is no type of cable use for which lead is the only material that can be applied satisfactorily. Lead may be the only present answer for certain installations, considering today's technology, but given sufficient time substitute materials will probably appear.

However, there are currently certain problems in connection with lead-covered cables that, if solved, would make their use more attractive. Installation of a joint in a lead-covered cable requires the use of a skilled craftsman trained in the art of wiping lead joints and a considerable amount of time for the job. This has generally been considered a necessary evil, but the question arises whether it is entirely necessary after seeing the developments made for non-leaded cable.

It was necessary to develop simplified joints and

Fig. 3. Heavy load concentrations in congested areas require lead-sheathed cables in conduit-and-manhole system.

techniques for solid-dielectric cable to make it salable. In consequence, preformed or plug-in splices and terminations were developed which require only proper trimming of the insulation and slipping the cable into the devices. Similar simplified splices and terminations for lead-sheath cables would do much to enhance their desirability and economic worth.

Many utilities that had no previous experience with underground cables are today involved with URD installations. Success with solid-dielectric cables in direct-buried applications may make these utilities inclined to apply the same type of cables to conduit systems. Single- and three-conductor solid-dielectric cables with lead sheaths would fit this application admirably if simplified techniques for making joints and terminations could be devoloped.

Still another problem with lead-sheathed cables is corrosion. The present solution is to install a protective extruded jacket over the lead sheath at a cost that makes the lead cable less attractive economically. A less expensive method of preventing corrosion on lead sheaths would be desirable.

Lead-sheathed cable has had a long and vital role in the electric-power industry. Research and development in this area will certainly contribute in changes in the art lying ahead so that lead-sheathed cables can continue to share in this expanding market. T&D

*Editor's Note—This article is based on a paper presented by the author before a recent meeting of Lead Industries Association.*

## THE AUTHOR

Carl Peters, superintendent of t&d engineering for WEPCO, came to the company in 1948 after receiving his degree in electrical engineering from Marquette. Mr. Peters is a member of IEEE and a registered professional engineer in Wisconsin.