Pneumatic Protection of Telephone Cable Networks

System Design Data

1. Introduction

The value of pneumatic protection has, comparatively speaking, only recently been recognised again, and it is the object of this publication to increase this recognition, as well as to provide a theoretical basis for system evaluation. Pneumatic protection is of value both in maintaining a system in working order, despite the appearance of minor leaks in the sheath, and in enabling the leaks to be located. It also helps to minimize the spread of damage arising from a major fault.

Drallim Cable Pressure Unit

The use of pneumatic pressure for test purposes during cable installation is well known, and it was used as long ago as 1843 for the continuous protection of underground telegraph circuits. In this early application, carried out for certain British railways and described in the Practical Mechanic of July 1843, Mr. William Fothergill Cooke devised a system in which copper wires were insulated with varnished cotton and were contained in air-tight iron tubing laid in the ground. Insulation was dependent on the exclusion of moisture, and the tubing was kept charged with dry air from a reservoir at a pressure of 3 psi.

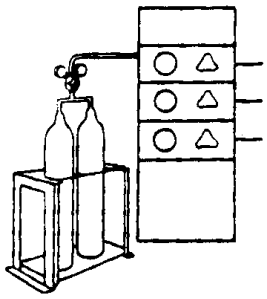
In the absence of pneumatic protection, the immediate effect of a sheath failure is that the cable becomes subject to flooding, and extensive damage can occur before remedial measures are undertaken. The fact that a fault has occurred is first indicated by deterioration of the transmission characteristics of the cable circuits, probably to the extent that revenue is lost. In paper insulated cable, the deterioration is likely to be relatively rapid and localized, probably affecting all circuits, and can be detected by routine insulation resistance tests. In plastic insulated cable, the effects of moisture may become widespread before detection, although not all circuits will necessarily be affected. In either case, once the damage is detected, maintenance work is an urgent matter and location of the sheath fault may be by no means easy, particularly in plastic insulated cables.

With pneumatic protection, extensive degradation is prevented. In addition, suitable alarms can be fitted and pressure measurements made, whereby leaks can be detected sooner and located more easily. Consequently, maintenance work ceases to be urgent and can be scheduled to fit in with other requirements.

Pneumatic protection may be applied in various ways, depending on the type of cable installation in question. The three most clearly distinguished pneumatic systems are listed below.

2. Types of Protection

Static



1-Early warning of fault development and approximate indication of location.

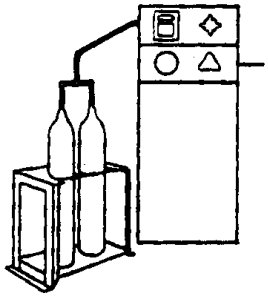
2-High standard of protection.

3-Appropriate to lead sheathed cables for highest level of circuit security.

The high standard of maintenance essential to trunk cables and other high security cables means that it is appropriate to keep the sheath in near-perfect condition, and that the earliest possible warning of trouble is desirable. This is provided for by the use of alarm contactors at relatively frequent intervals along the cable route, so that the occurrence of a fault can be detected before the drop of pressure becomes widespread.

No practical system can be completely sealed, although a static system in proper working order is characterized by a low consumption of gas, and hence by the provision of gas supply equipment of a simple type. Nevertheless, if static protection is to be applied to an existing cable, consumption in the early phases is likely to be considerable. The main expense will lie in the installation of alarm equipment and in the tests and investigation needed to locate and remedy existing defects.

Scavenge



1 - Maintains first-class electrical performance despite permeation of moisture through sheathing material.

2 - Suitable for plastic sheathed trunk cables.

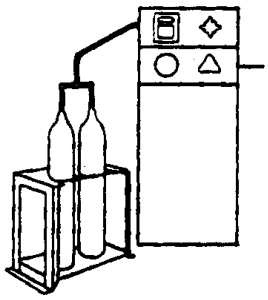
The scavenge system is a refinement of the static system. Whereas in a lead sheathed cable a static pressure is sufficient to provide protection until the development of a serious leak, in a plastic sheathed cable the moisture permeating through the sheath into the cable must be swept away continuously if a build-up of humidity is

to be avoided. The cable is divided pneumatically

into sections, each fed at one end and discharged at the other at a controlled pressure, thus ensuring a steady flow of gas throughout the whole length. If this is

done, the cable near the gas supply points will remain extremely dry, while the humidity within the cable will increase with distance. This applies to all plastic sheathed cables, whether paper insulated or plastic insulated, the only difference being in the level of humidity that can be tolerated.

Gas-Loss



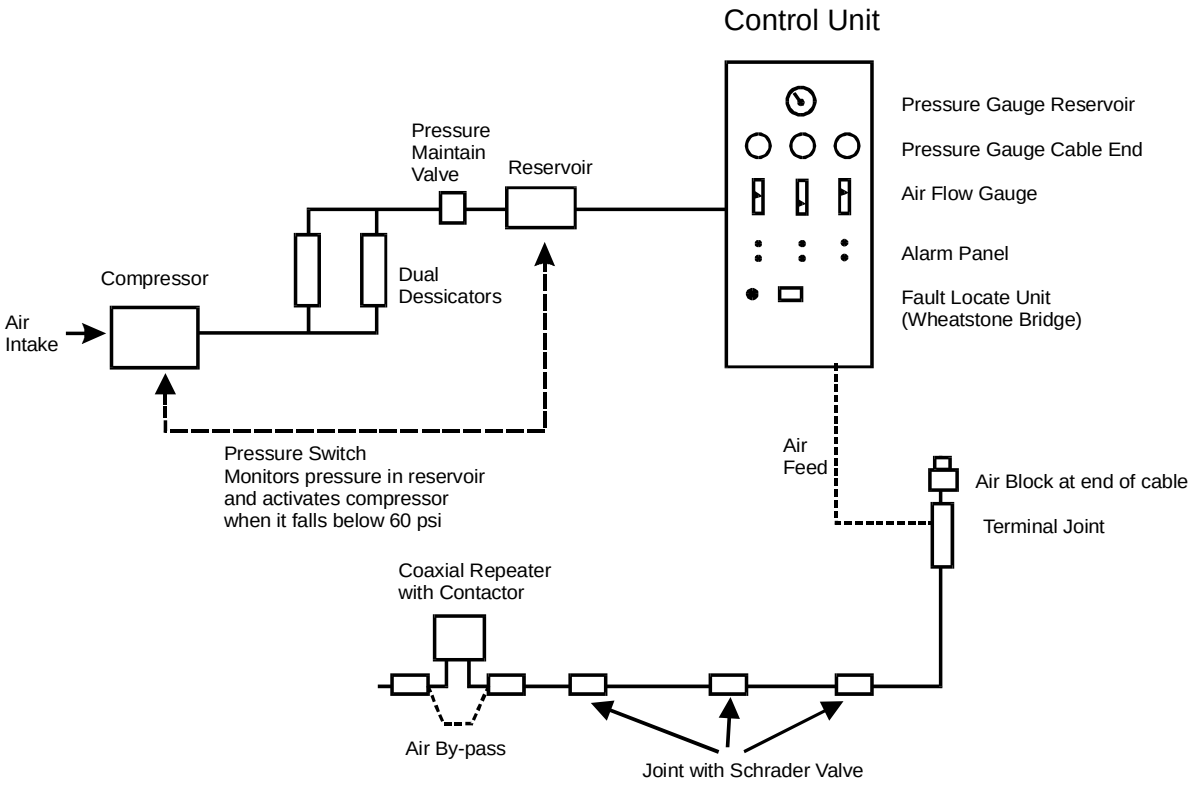
1-Protection for most important distribution cables follows immediately on initial installation of plant.

2-Range and effectiveness of protection can be increased whenever the necessary effort is available.

3-Suitable for exchange networks.

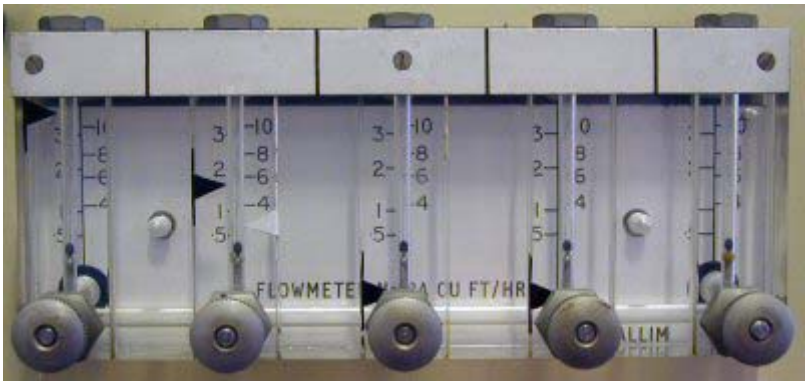
Elaborate methods of pneumatic protection are not appropriate to a distribution network. The most important cables are those radiating immediately from the exchange, the smaller branches being progressively less important. Thus, with very little preliminary work, protection can be given to the most important cables simply by connecting a dry gas supply plant to them. The distance to which the protection will spread depends on the condition of the cables, but once the ends of the main cables have been sealed, pressure can be applied.

Observations of gas consumption and pressure distribution along these cables can then begin, and on the basis of these observations work can be planned to seal existing leaks and remove any blockages there may be. Pneumatic inter-connections can later be made to the branch cables and-alarm contactors fitted at the points to which protection is to extend. In this way, full protection is obtained and the need for maintenance becomes known as it arises.



Schematic Diagram of a Pneumatic Protection Network

Cable is maintained at a pressure opf 9 p.s.i. with contactors set to alarm at 6 p.s.i.



Air Flow Meters

3. Summary

Pneumatic protection should be applied to cable systems wherever there are economic advantages in doing so. If, without pneumatic protection, the cable system maintenance involves any appreciable amount of overtime work, or if there is appreciable loss of revenue due to sheath failure, the application of pneumatic protection will result in a significant reduction in these costs; 25 per cent has been instanced in this connection. In addition, in a local network, a reduction in service complaints due to cable faults can be expected, perhaps by as much as 70-80 per cent. In cables serving establishments of national importance, pneumatic protection will help greatly to ensure reliable service. In new installations, either trunk or local, the value of pneumatic protection can only be judged by the importance of the projected system and the financial savings which have been shown to be possible from experience of existing installations: In projected systems totalling 10-20 miles of more of cable, the advantages of pneumatic protection art well worth investigating, since in addition to the advantages already enumerated, the expectation of life of the cables will be extended because of the greater ease with which faults can be accurately located and repaired.

Various items of fixed and portable equipment are required, depending on the type of pneumatic system to be installed. These items and their uses are described in the Catalogue section of this publication.

4. Notes on this document

This document was discovered as a photocopy among the course notes from a British Railways cable jointers course. It has no attribution, but I deduce that came from Drallim Industries Ltd. Therefore the text and diagrams must be considered The photographs were taken at Sheffield Sheaf House exchange before its removal and are