

INVESTIGATION INTO THE DOWNTOWN VANCOUVER POWER OUTAGE OF 14 JULY 2008

Khaled **ABDOLALL**, John **VANDERMAAR**, Powertech Labs Inc., (Canada),
kal.abdolall@powertechlabs.com, john.vandermaar@powertechlabs.com
 Dexter **TARAMPI**, BC Hydro (Canada), dexter.tarampi@bchydro.com

ABSTRACT

This paper presents the results of an investigation into the power outage on 14 July 2008 in downtown Vancouver, caused by a fire and explosion in one of the downtown manholes. This resulted in 14 underground, 12 kV distribution circuits being left without power for several days. The investigation found the root cause of the explosive fire to be an overheating connector on a 600A elbow of a T connection. The results of the investigation are discussed in terms of test protocols and condition assessment test programs used to identify such problems.

KEYWORDS

Cable Faults, Distribution, Connectors, Explosion, Condition Assessment

INTRODUCTION

On 14 July 2008 there was a major power outage in downtown Vancouver, British Columbia. Fire was reported in Manhole 2445 and ten feeders were tripped by their protective relays, two feeders were switched out manually, and two feeders tripped automatically with no relay targets. According to the records the first fault occurred on CSQ12F215 at 8:54 AM, followed by a cascade of faults on the other feeders in the manhole with the last fault occurring at 10:41:42 AM. All the protective relays were functioning correctly and cleared the faults within the specified limits. Table 1 gives information on the circuits, cable types, and splices in the manhole.

Table 1: Circuits, Cables and Splices in the Manhole

Circuit	Information from the line diagrams	
	Cable Type	Splice
12F212CSQ	A27	XLPE → XLPE
12F215CSQ	A8, A24, A27	XLPE → PILC T (3) PILC → XLPE
12F225CSQ	A26, A8	PILC → XLPE
UC7F147	A8, G7, A8	PILC → PILC T
12F211CSQ	A18	PILC → PILC
12F626 CSQ	A25, A25	XLPE → XLPE
12F226CSQ	A23, A8	PILC → XLPE
12F221CSQ	A8, G7	PILC → XLPE
12F223CSQ	A8, A26	PILC → XLPE
UC7F83	A20, 1/0 AI	??
4F52MUR	C1	PILC → PILC
4F56 MUR	C2	PILC → PILC
12F451	A8, A8	PILC → PILC
12F625CSQ	A25	XLPE → XLPE
12F124CSQ	A27	XLPE → XLPE
12F95DGR	1/0 service	?

Table 2: Cable Codes

Voltage Rating	Cable Code	Number of Conductors	Type of Conductor	Diameter of Conductor (mm)
15 kV	A8	3C	400 KCM PILCPJ GN	16.08
	A18	3C	600 KCM PILCPJ GN	19.67
	A20	1C	#1/0 AI CN	8.25
	A23	1C	500 KCM AI XLPE 1/3 CN	17.95
	A24	1C	750 KCM AI XLPE 1/3 CN	22.00
	A25	1C	500 KCM AI XLPE Shielded Neutral	17.95
	A26	1C	750 KCM AI XLPE 1/3 CN	22.00
	A27	Unknown		
5 kV	C1	3C	500 KCM PILC	17.95
	C2	3C	350 KCM PILC	15.01
25 kV	G7	1C	750 KCM XLPE AI (1/3 CN)	22.00
	1/0 service			
	1/0 AI			

As part of the condition assessment test program of the BC Hydro underground distribution network a routine inspection was carried out in MH2445 by the BC Hydro Cable Department on 3 January 06. No problems were reported other than a splice leak on MUR4F52. On 22 January 2008 a detailed condition assessment was carried out by Powertech Labs on MH2445 [1]. During that inspection the following were the main findings in MH2445:

- Elevated temperature on a T connection of CSQ12F215. The temperature of the connector was 5.3 °C above the temperature of the connecting cable. This connection was installed in 2005.
- An oil leak on CSQ12F223.
- Partial discharge was detected on CSQ12F223 and CSQ12F211.

At the time these results were not considered sufficiently high to warrant immediate action. The normal practice has been to discuss the results of the draft report after the testing and analysis has been completed. At a team meeting attended by all of the stakeholders final recommendations on the course of action on all of the circuits tested are made. The rationale for this approach is