



Test Report

DATE ISSUED: 9 March 2023

DEVICE TESTED: AusProof KBX Cold Shrink Stress Relief Tubes rated 6.6 kV to 35 kV

CLIENT'S NAME: AusProof Pty Ltd
6 Shona Avenue
Gladstone
Queensland 4680
Australia

CLIENT'S REFERENCE: PO 87249

TEST SPECIFICATION: Client specified partial discharge tests and dielectric test.

DATE OF TEST COMPLETION: 9 March 2023

SUMMARY OF RESULTS: Cable samples tested exhibited less than 2 pC partial discharges when fitted with KBX Cold Shrink Stress Relief Tubes
Dielectric strength of the KBX Cold Shrink Stress Relief Tubes exceeded 15 kV/mm
Refer to the results section of this report for further details.



All tests reported herein have been performed in accordance with the Laboratory's scope of accreditation, Accreditation Number: 42

Approved Signatory: K Manson



Checked By: G I Dix



International Accreditation New Zealand (IANZ) has a Mutual Recognition Arrangement (MRA) with the National Association of Testing Authorities (NATA), Australia, such that both organizations recognize accreditations by IANZ and NATA as being equivalent. Users of inspection reports / certificates are recommended to accept inspection reports / certificates in the name of either accrediting body.

Testing notes

Description of equipment tested

The following devices were submitted for partial discharge tests:

KBX Cold Shrink Stress Relief Tubes

| Cold Shrink Tube Part number | Specified Cable diameters | Class | Tested cable diameter (mm) (total/insulation) |
|------------------------------|---------------------------|--------|---|
| RS2484 | 11-25 mm | Small | 19.9/17.8 |
| RS2485 | 17-30 mm | Medium | 29.5/28 |
| RS2486 | 24-50 mm | Large | 34.5/32.8 |

Client supplied cold shrink stress relief tubes and cable samples were used for the tests.

The following personnel were present during testing:

Laboratory staff: K Manson and G I Dix

Test Laboratory Atmospheric Conditions

Temperature 18 (± 4) $^{\circ}$ C.

Pressure 101 (± 0.5) kPa

(Approximate height above local sea level is 30 m).

Laboratory Equipment

Manually set 25cm sphere-gap;

Biddle balanced partial discharge detector 665700 (Zm, PDS)

Biddle partial discharge system master calibrator 6617250

Oscilloscope

Heafely 2000 pF discharge free 200 kV capacitor (Ck).

Hipotronics 150 kV 150 kVA ac dielectric test set

Resistive voltage divider and true RMS indicator (Hipotronics KVM300)

Fluke 287 DVM

Miscellaneous laboratory equipment including: assman hygrometer, barometer, and a mercury-in-glass thermometer.

Measurement Uncertainties

Refer to the Laboratory accreditation details at www.ianz.govt.nz for information on measurement uncertainty.

Test procedures, Results

1) Partial discharge tests

Test voltages were applied between the conductor and an earth connection at the centre of the cable sample using a Hipotronics 150 kV 150 kVA ac dielectric test set operated from the laboratory mains supply. The voltage was measured using a resistive voltage divider and true RMS indicator (Hipotronics KVM300).

Discharge levels were measured using a Biddle balanced bridge discharge detector. The bridge was balanced according to the bridge manufacturer's instructions. The measurements system was calibrated by injecting a known discharge between the conductor and the cable sheath. The system calibration was checked at 10 pC and at 100 pC. Background discharge levels were recorded. Discharge levels were measured using an oscilloscope and the bridge meter.

Test voltages were applied to the cable samples without Cold Shrink Stress Relief Tubes installed and with Cold Shrink Stress Relief Tubes installed

Discharge test voltages were based on the following system voltages:

| | | | | | |
|------------------------|------|-------|-------|-------|-------|
| Rated P-P voltage (V) | 8700 | 15000 | 22000 | 25000 | 35000 |
| Phase to earth (V) | 5830 | 8660 | 12700 | 14440 | 20200 |
| Discharge test voltage | 5830 | 9526 | 13970 | 15884 | 22220 |

Background discharge level during the tests were less than 1 pC

Discharge levels (pC) without Cold Shrink Stress Relief Tubes installed:

| Cable | Test Voltage(V) | | | | | Discharge Inception (kV, pC) | Extinction (kV) |
|--------|-----------------|------|-------|-------|-------|------------------------------|-----------------|
| | 5830 | 9526 | 13970 | 15884 | 22220 | | |
| Small | <1 | 10 | * | * | * | 9.8 kV, >1000pC | 7 |
| Medium | * | * | * | * | * | 5.8 kV, >1000 pC | 4.8 |
| Large | * | * | * | * | * | 5.6 kV, >1000 pC | 4.2 |

* - test terminated before voltage reached due to excess PD (>1000 pC)

Discharge levels (pC) with Cold Shrink Stress Relief Tubes installed:

| | Test Voltage (V) | | | | |
|----------------|------------------|------|-------|-------|-------|
| Sample, cable | 5830 | 9526 | 13970 | 15884 | 22220 |
| RS2484, Small | <1 | <1 | <1 | <1 | <1 |
| RS2485, Medium | <1 | <1.2 | <1 | <1.2 | <1 |
| RS2486, Large | <1 | <1 | <1.2 | <1.2 | <1.2 |

2) Dielectric strength

A voltage was applied to a sample taken from each of two Cold Shrink Stress Relief Tubes.

The test voltage was applied using two electrodes, the ground electrode was 76 mm diameter, the HV electrode diameter was 20 mm.

Voltage applied to each sample was increased at a rate of approximately 0.5 kV/second starting at 0 V until breakdown occurred. The test was carried out under oil.

The atmospheric conditions during the test were:

21 ±1 °C

101.5 ±1 kPa

68 % RH

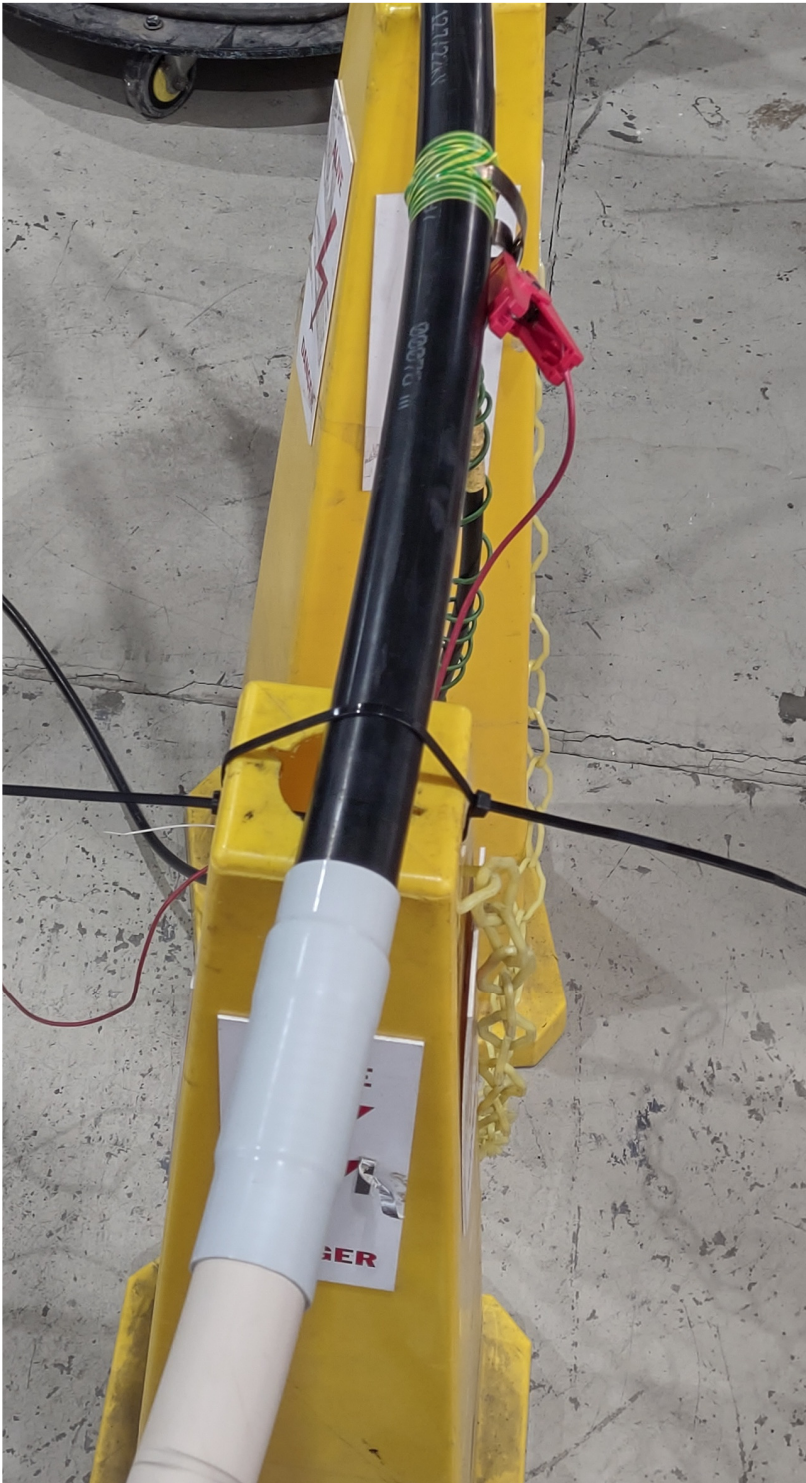
| Sample | Average Sample Thickness (mm) | Breakdown Voltage (kV) | Dielectric Strength (kV/mm) |
|--------|-------------------------------|------------------------|-----------------------------|
| 1 | 2.4 | 37.8 | 15.8 |
| 2 | 2.45 | 37.8 | 15.4 |

Report Number: PL1792-PD-1

Pictures:



Picture 1 Cable sample, Cold Shrink Stress Relief Tube not installed



Picture 2 Cable sample with Cold Shrink Stress Relief Tube installed