



Test Report

DATE ISSUED:	15 December 2022
DEVICE TESTED:	AusProof 22 kV 425 A Coupler
RANGE NUMBERS:	224BKA, 224BKAFO, 224BKAE, 224BSTDKA, 224B2PKA, 224BSTDKAFO, 224BSTDKAE
CLIENT'S NAME:	AusProof Pty Ltd 6 Shona Avenue Gladstone Queensland 4680 Australia
CLIENT'S REFERENCE:	Email: Clinton Taylor
TEST SPECIFICATION:	Client specification including references to AS/NZS 1300, AS/NZS 1299, C22.2 No 298
DATE OF TEST COMPLETION:	22 November 2022
SUMMARY OF RESULTS:	The sample device tested complied with the requirements of the above test specification.



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.

PowerLab Limited, PO Box 31034 Christchurch 8444 New Zealand, 5 Sheffield Crescent Christchurch New Zealand, Info@powerlab.co.nz. This Report must not be quoted except in full.

Testing notes

The following personnel were present during testing:

Laboratory staff: K Manson and G I Dix

Tests Performed

Test number	Test	Standard/Clause	Test value
1	Phase to phase + earth AC 50 Hz 1 minute	AS/NZS 1299 AS/NZS 1300	46 kV for 1 minute
2	Phase to phase + earth AC 50 Hz 4 hours	AS/NZS 1299 AS/NZS 1300	40 kV for 4 hours
3	Pilot to earth 50 Hz	AS/NZS 1300 AS/NZS 1299	1000 V for 1 minute
4	Impulse	AS/NZS 1300 AS/NZS 1299 AS/NZS 2802 C22.2 No. 298	125 kV and 150 kV
5	Partial Discharge	AS/NZS 1300 AS/NZS 1299 C22.2 No. 298	Inception and extinction 10% greater than 12.7 kV, Max 100 pC
6	Ingress protection	AS 60529	IP68
7	Short circuit test (phase)	AS/NZS 1300 AS/NZS 1299 C22.2 No. 298	20 kA for 1.0 s
8	Bonding (earth) path current test	C22.2 No. 298	5.01 kA for 9 s
9	Temperature rise	ASNZS1300 ASNZS1299 C22.2 No. 298	425 A

Supplementary Tests Performed

10	Phase to phase + earth AC 50 Hz 6 hours	C22.2 No. 298 AS/NZS 1299 AS/NZS 1300	40 kV for 6 hours
11	Phase to phase + earth AC 50 Hz 1 minute	C22.2 No. 298 AS/NZS 1299 AS/NZS 1300	50 kV for 1 minute

Test Laboratory Atmospheric Conditions

Temperature 12 (± 5)°C.

Pressure 100 (± 5) kPa

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

Laboratory Equipment

Ferranti inverted Marx impulse generator configured with 3 stages rated at 100 kV, 0.24 μ F per stage;
Laboratory manufactured adjustable transfer, tail and front resistors;
Laboratory manufactured impulse generator control and firing equipment;
Haefely 600 kV peak capacitor voltage divider/chopping gap;
Haefely 64M Impulse Peak Voltmeter;
Manually set 25cm sphere-gap;
Biddle balanced partial discharge detector 665700 (Zm, PDS)
Biddle partial discharge system master calibrator 6617250
Oscilloscope
Haefely 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
Tektronix TDS3034 Four Channel digitizing oscilloscope;
11 kV/440 V short circuit transformer
20,000/5 CT
1000/5 CT
Laboratory constructed point on wave switch
Inductors and Resistors
Laboratory manufactured current viewing resistor; and
Miscellaneous laboratory equipment including: assman hygrometer, barometer, and a mercury-in-glass thermometer.
Agilent 34970A data acquisition system

Measurement Uncertainties

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

Coupler test connection, terminations and fittings

The sample coupler assemblies tested were terminated with Client supplied cables, potting compound and fittings.

Although these are required for testing, they are not considered to be part of the sample device tested.

Test procedures, Results

1. AC Voltage withstand test (phase conductors)

The specified test voltage was applied between the specified conductors and the coupler body 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). A stopwatch was used to monitor time of application.

46 kV rms was applied between the conductors and the coupler body for a period of 1 minute.

During the high voltage test no disruptive discharges, - flashovers or insulation punctures were noted.

The insulation resistance was greater than 1 G Ω , each phase to earth.

Result: **Complies**

2. AC Voltage withstand test (phase conductors)

The specified test voltage was applied between the specified conductors and the coupler body 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). A stopwatch was used to monitor time of application.

40 kV rms was applied between the conductors and the coupler body for a period of 4 hours.

During the high voltage test no disruptive discharges, - flashovers or insulation punctures were noted.

The insulation resistance was greater than 1 G Ω , each phase to earth.

Result: **Complies**

3. AC Voltage withstand test (pilot conductors)

The specified test voltage was applied between the specified conductors and the coupler body 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). A stopwatch was used to monitor time of application.

1 kV rms was applied between the pilot conductor and the coupler body for a period of 1 minute.

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During the high voltage test no disruptive discharges, - flashovers or insulation punctures were noted.

Result:

Complies

4. Impulse test

A Ferranti impulse generator with a Haefley voltage divider and peak voltmeter was used. The wave shape was adjusted by means of interchangeable front and tail resistors to be within the allowed tolerances.

Ten impulses of each polarity were applied as specified in the Standard. Each impulse was monitored by digital comparison with a stored reference.

The applied impulse was monitored using a Tektronix digitising oscilloscope.

Wave shape was 1.0/44 μ s. Refer to Figure 1

The test voltage was 125 kV peak.

The test was then repeated with a test voltage of 150 kV peak

During the application the 125 kV impulses no disruptive discharges, flashovers or insulation punctures were noted.

Result (125 kV):

Complies

During the application the 150 kV impulses no disruptive discharges, flashovers or insulation punctures were noted.

Refer to Figure 1.

Result (150 kV):

Complies

5. Partial discharge test

The specified test voltage was applied between the conductors and the coupler body 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.

Background discharge level was less than 2 pC

	Voltage (kV)	Discharge Level
Inception	19.1	200 pC after inception
Extinction	16.7	< 2 pC after extinction

Result:

Complies

6. Ingress Protection

Two sample couplers were assessed according to AS 60529 to determine compliance with IP 68.

CI 13.3	Ingress of Solid Objects Test (AS 60529)			P
Ingress Test Performed	Location of probe applied	Force applied (N)	Clearance measured	Verdict
Unit 3				
IP1X	Enclosure Ends, Cable Rubber Entry, Bungs.	50	No entry/damage	P
IP2X	Enclosure Ends, Cable Rubber Entry, Bungs.	30	No entry/damage	P
IP3X	Enclosure Ends, Cable Rubber Entry, Bungs.	3	No entry/damage	P
IP4X	Enclosure Ends, Cable Rubber Entry, Bungs.	1	No entry/damage	P
Unit 4				
IP1X	Enclosure Ends, Cable Rubber Entry, Bungs.	50	No entry/damage	P
IP2X	Enclosure Ends, Cable Rubber Entry, Bungs.	30	No entry/damage	P
IP3X	Enclosure Ends, Cable Rubber Entry, Bungs.	3	No entry/damage	P
IP4X	Enclosure Ends, Cable Rubber Entry, Bungs.	1	No entry/damage	P

CI 13.6	Ingress of Dust Test (AS 60529)				P
EUT identification	Degree of protection (Dust)	Duration of test (hr)	Ambient temperature (°C)	EUT ambient (°C)	Verdict

Unit 3	IP6X	6.8	15.4	20.1	P
Unit 4	IP6X	6.8	15.1	20.5	P

CI 14.3	Ingress of Water Test (AS 60529)					P
EUT identification	Degree of protection (Water)	Depth of EUT from surface (m)	Duration of test (min)	Ambient temperature (°C)	Water Ambient temperature (°C)	Verdict
Unit 3	IPX8	1.1	60.0	15.2	17.0	P
Unit 4	IPX8	1.1	60.0	15.4	17.2	P

Result

Complies

7. Short-circuit (though-fault) test

The device was subjected to the test currents by use of a step down three phase transformer and inductors from an 11 kV supply and a phase controlled on switch and time controlled off circuit breaker:

Test 20 kA 0.2 s

Results: 0.22 s, 21.4 kA, n=2.0 (power factor = 0.3), 50 Hz, mean of 3 tests applied with 10 minutes between. Refer to Figure 2.

Test 20 kA 1.0 s

Results: 1.02 s, 19.7 kA, n=2.5 (power factor = 0.3), 50 Hz. Refer to Figure 3.

After current applications, there were no visible disturbance, pitting or burning.

Result

Complies

8. Bonding (earth) path current test

The earth continuity circuit was subjected to the following current waveform by use of a step down transformer and inductors from an 11kV supply and a phase controlled on switch and time controlled off circuit breaker:

Test 5.01 kA for 9 s

Results: 9.04 s, 5.1 kA, n=2.1, 50 Hz. Refer to Figure 4.

The earth continuity was measured on test completion.

After the current application the measured continuity was 0.0001 Ω .

Result

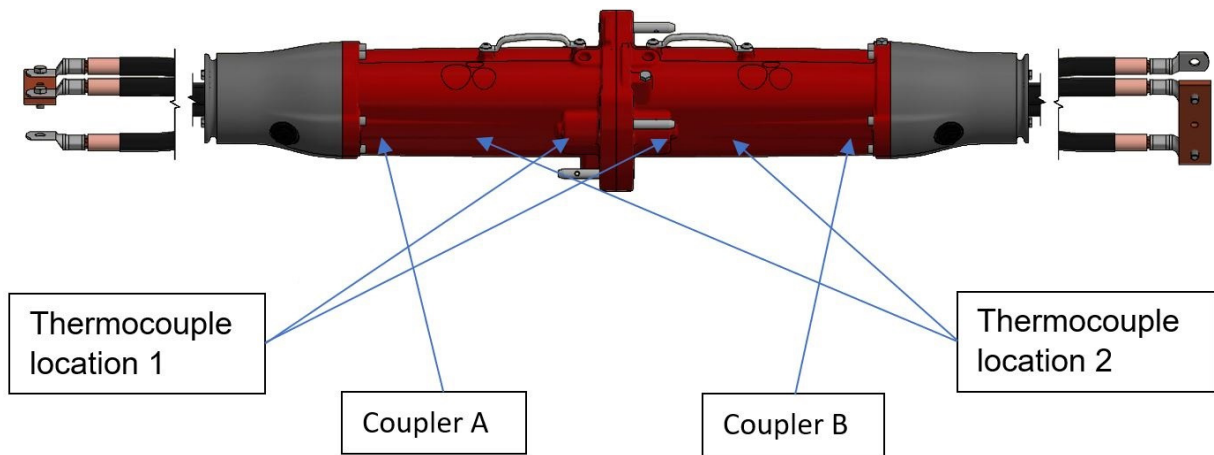
Complies

9. Temperature rise

All conductors were connected in series and thermocouples were placed as required by Clause 3.3.8.4 of AS/NZS 1300.

Thermocouple locations included:

- (a) Main contact adjacent to connecting device (1)
- (b) Main contact adjacent to cable conductor (2)
- (c) Cable conductor 1 m from cable gland



Location	Coupler	Thermocouple location	Phase ID
A	A	1	White
B	A	2	White
C	A	1	Blue
D	A	2	Blue
E	A	1	Red
F	A	2	Red
G	B	1	Blue
H	B	2	Blue
I	B	1	Red
J	B	2	Red
K	B	1	White
L	B	2	White

A current of 425 A was passed through the test object until the temperature variation did not exceed 2 K/h.

Location	A	B	C	D	E	F	G	H	I	J	K	L
Rise	25	25	29	26	25	25	29	17	28	25	29	26
Difference from cable	-13	-13	-9	-12	-13	-13	-9	-21	-10	-13	-9	-12

(Values are degrees Kelvin)

Result

Complies

Supplementary test procedures, Results

10. AC Voltage withstand test (phase conductors)

The specified test voltage was applied between the specified conductors and the coupler body 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). A stopwatch was used to monitor time of application.

40 kV rms was applied between the conductors and the coupler body for a period of 6 hours.

During the high voltage test no disruptive discharges, - flashovers or insulation punctures were noted.

The insulation resistance was greater than 1 GΩ, each phase to earth.

Result:

Complies

11. AC Voltage withstand test (phase conductors)

The specified test voltage was applied between the specified conductors and the coupler body 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). A stopwatch was used to monitor time of application.

50 kV rms was applied between the conductors and the coupler body for a period of 1 minute.

During the high voltage test no disruptive discharges, - flashovers or insulation punctures were noted.

Result:

Complies

Oscillograms

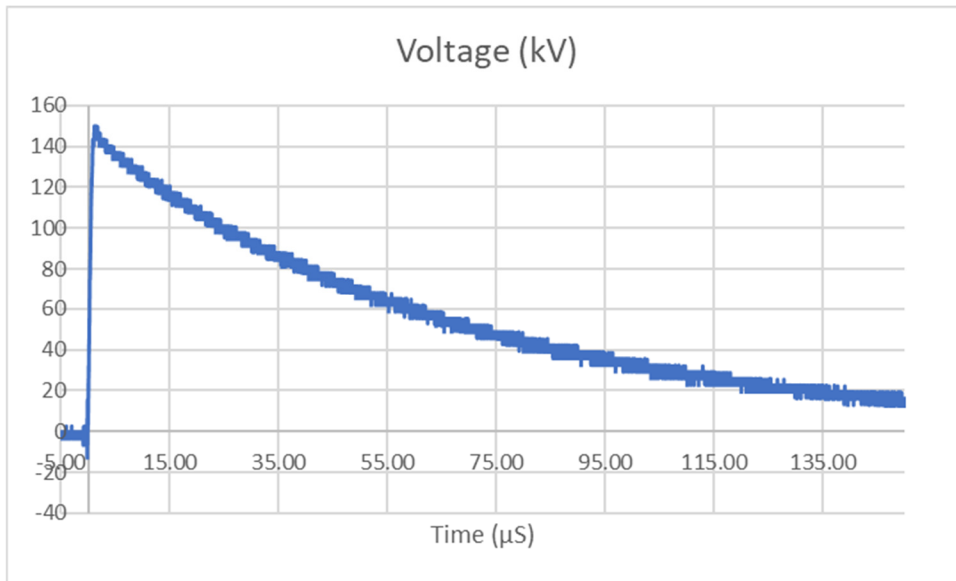


Figure 1. Last 150 kV impulse

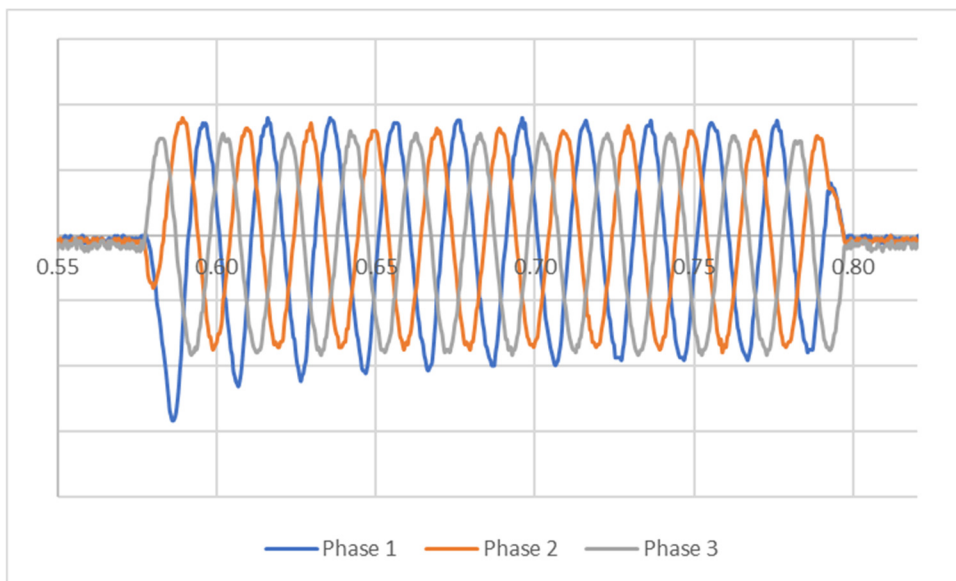


Figure 2. 20 kA for 0.2 s short circuit test number 3

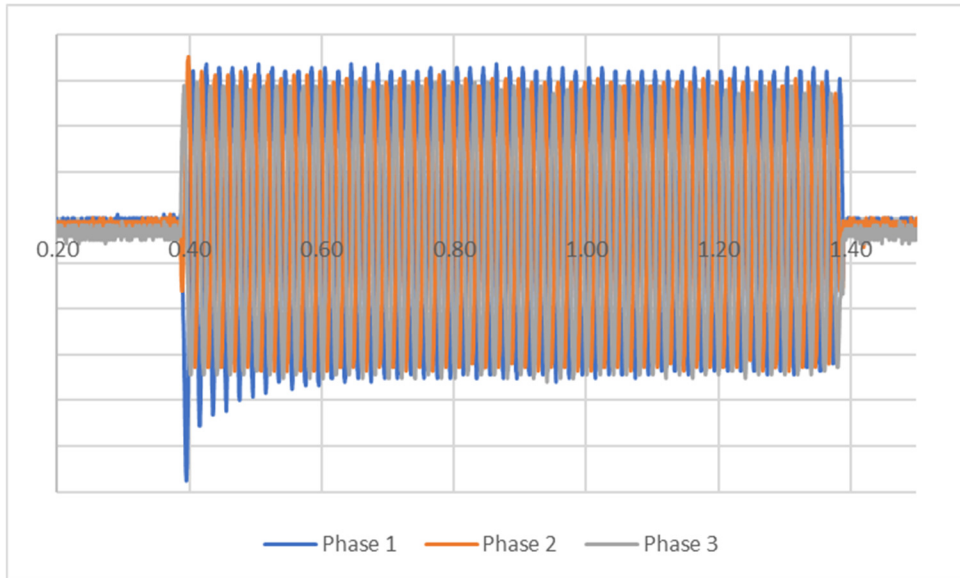


Figure 3. 20 kA for 1 s short circuit test

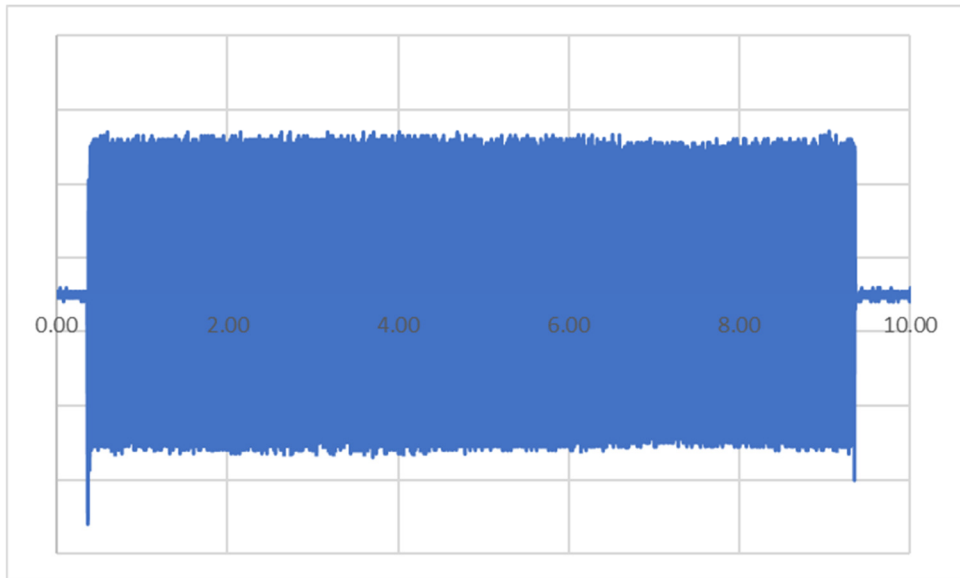
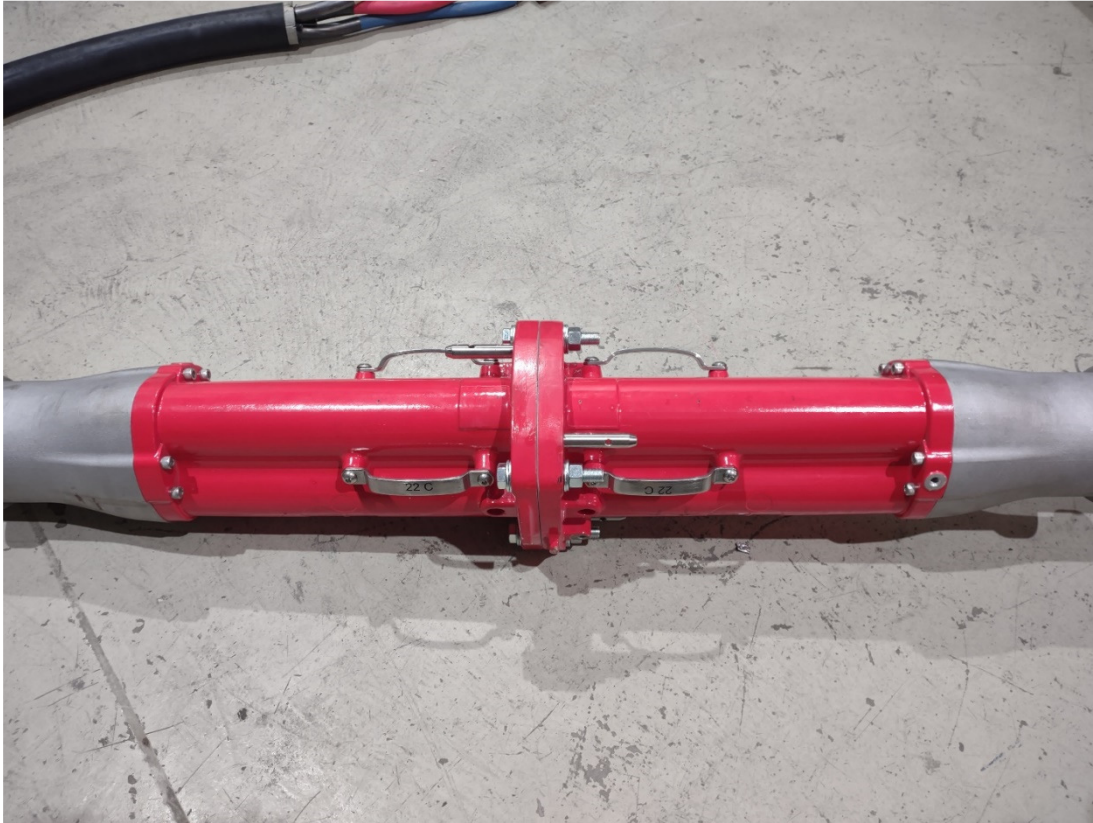


Figure 4. 5 kA for 9 s short circuit test

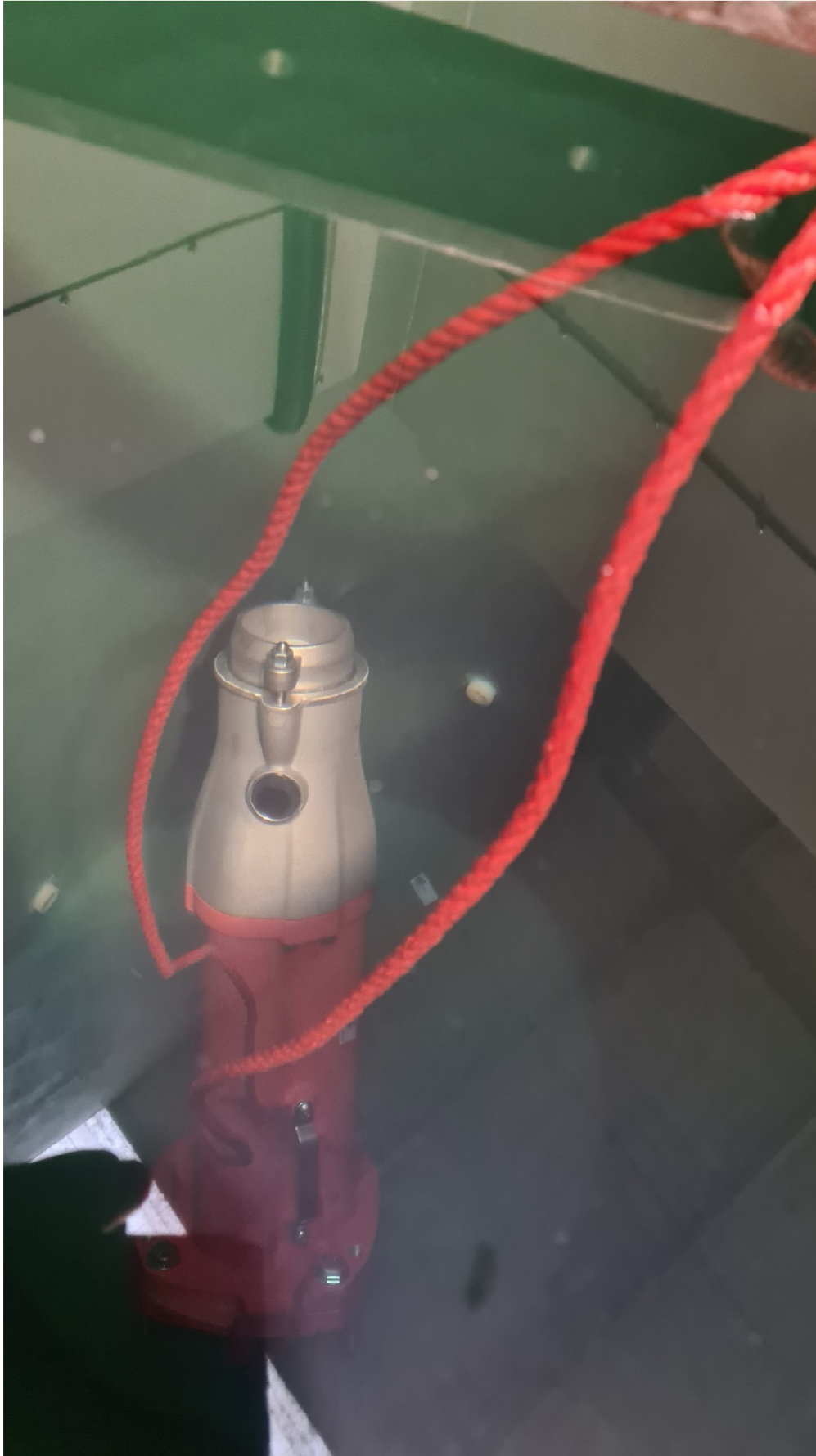
Pictures:



Picture 1 General view of coupler



Picture 2 Coupler in dust test



Picture 3 Coupler in 1 m water



Picture 4 Contacts after short circuit test

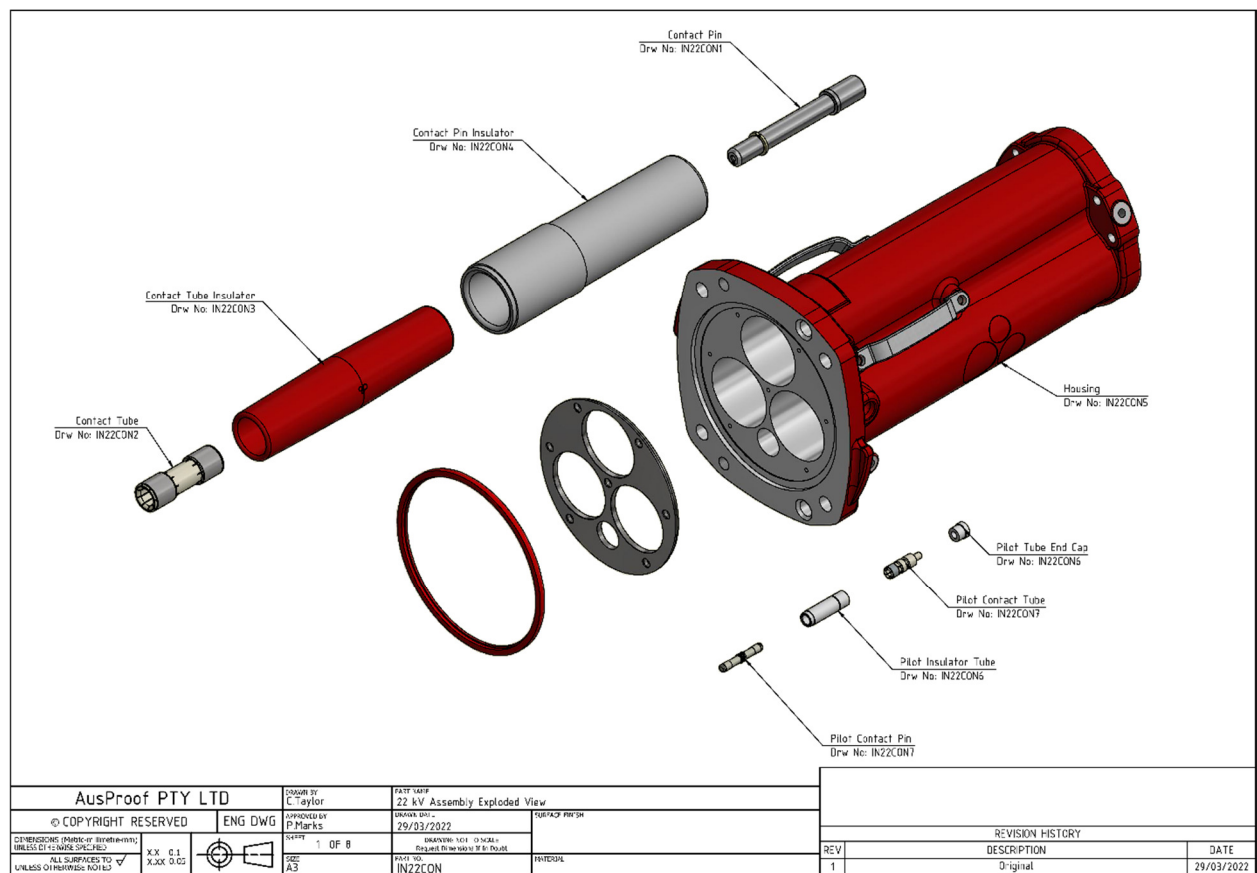


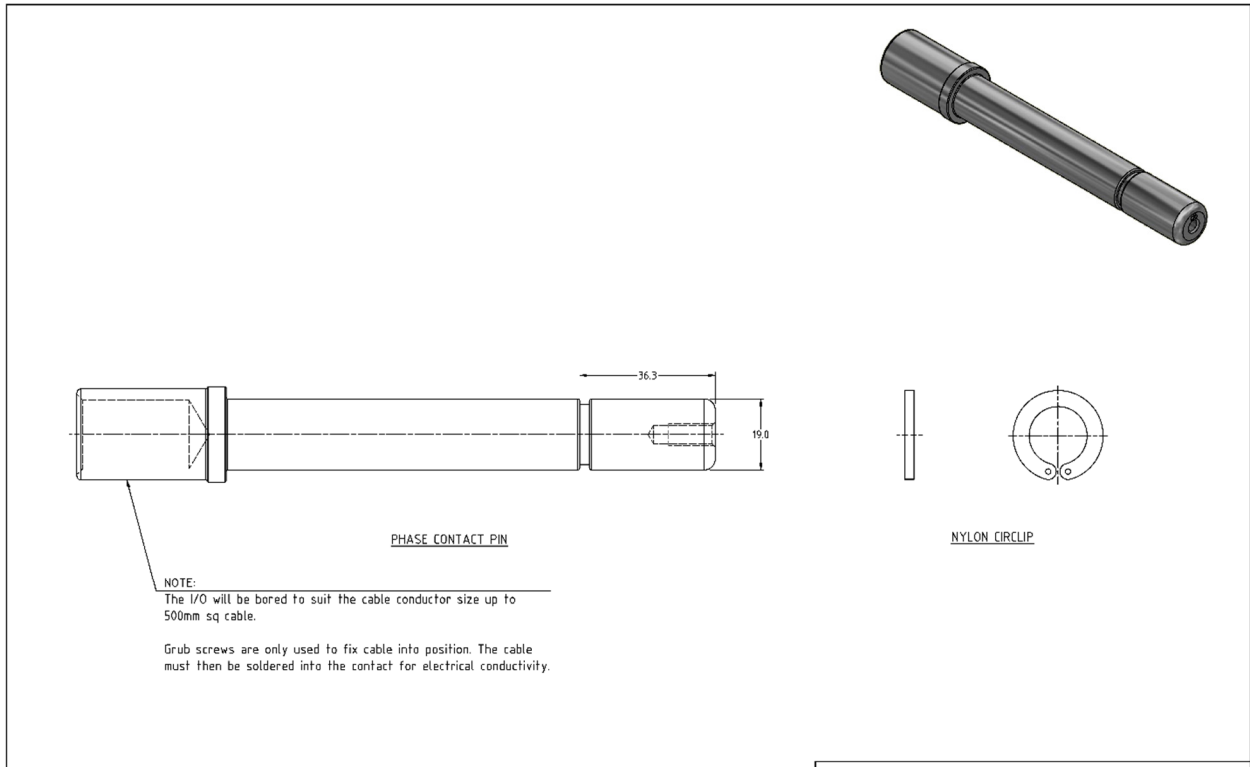
Picture 5 Contacts after short circuit test

Drawings:

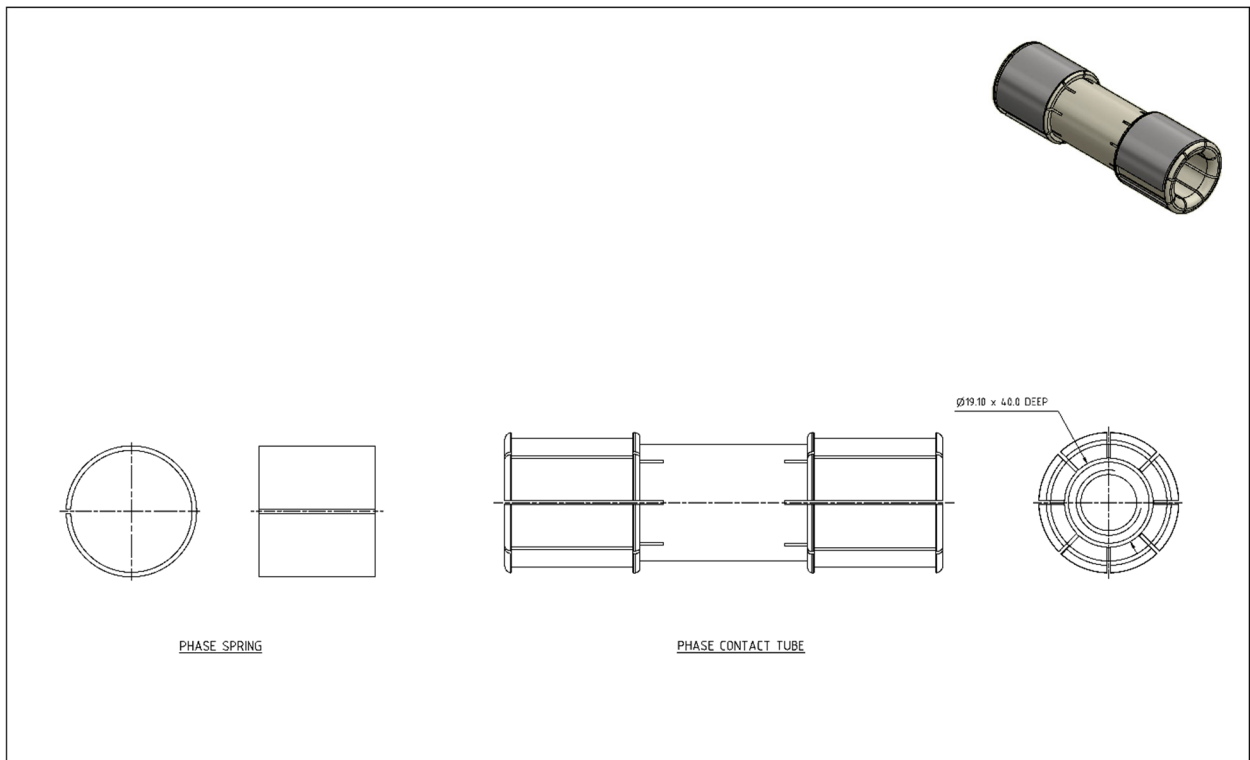
List of drawings:

No	Drawing No.	Title	Revision	Date
1	IN22CON	Cable coupler and components	1	29/03/2022
2	IN22CON1	Contact Pin	1	29/03/2022
3	IN22CON2	Contact Tube	1	29/03/2022
4	IN22CON3	Contact Tube Insulator	1	29/03/2022
5	IN22CON4	Contact Pin Insulator	1	29/03/2022
6	IN22CON5	Housing	1	29/03/2022
7	IN22CON6	Pilot Insulator	1	29/03/2022
8	IN22CON7	Pilot Pin/Tube	1	29/03/2022

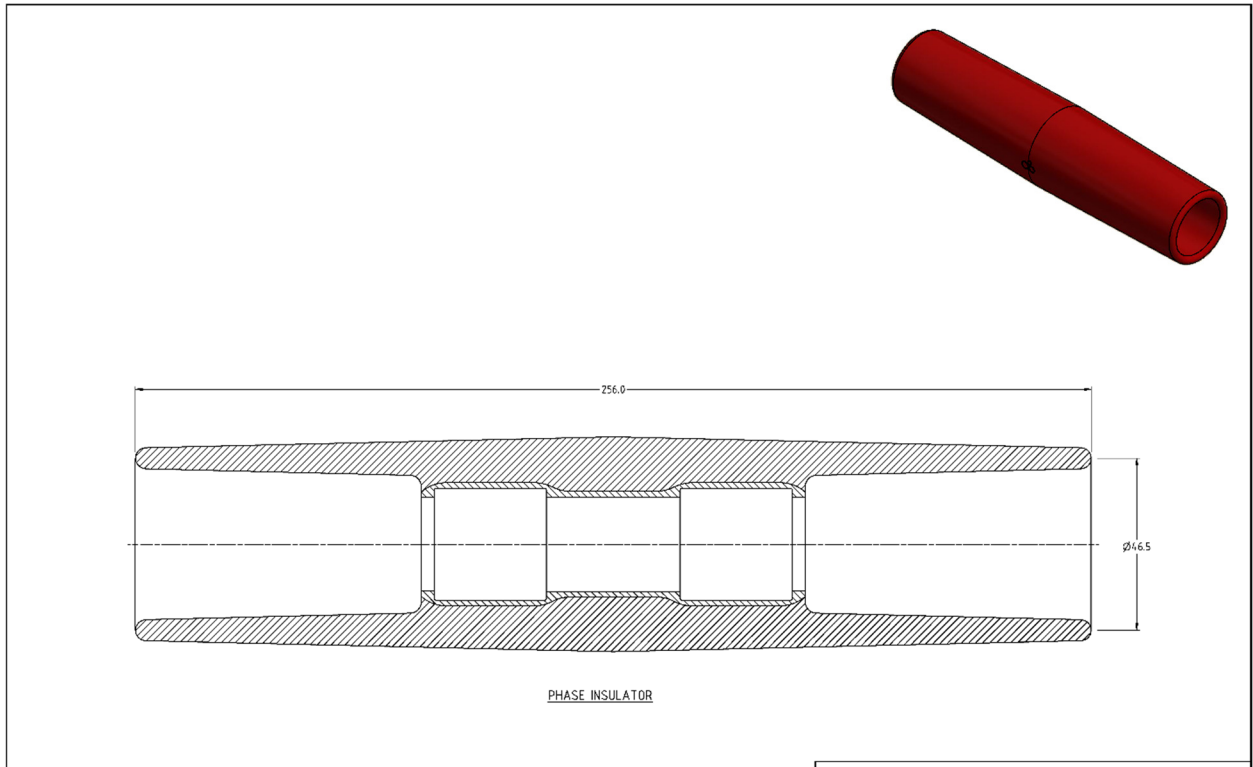




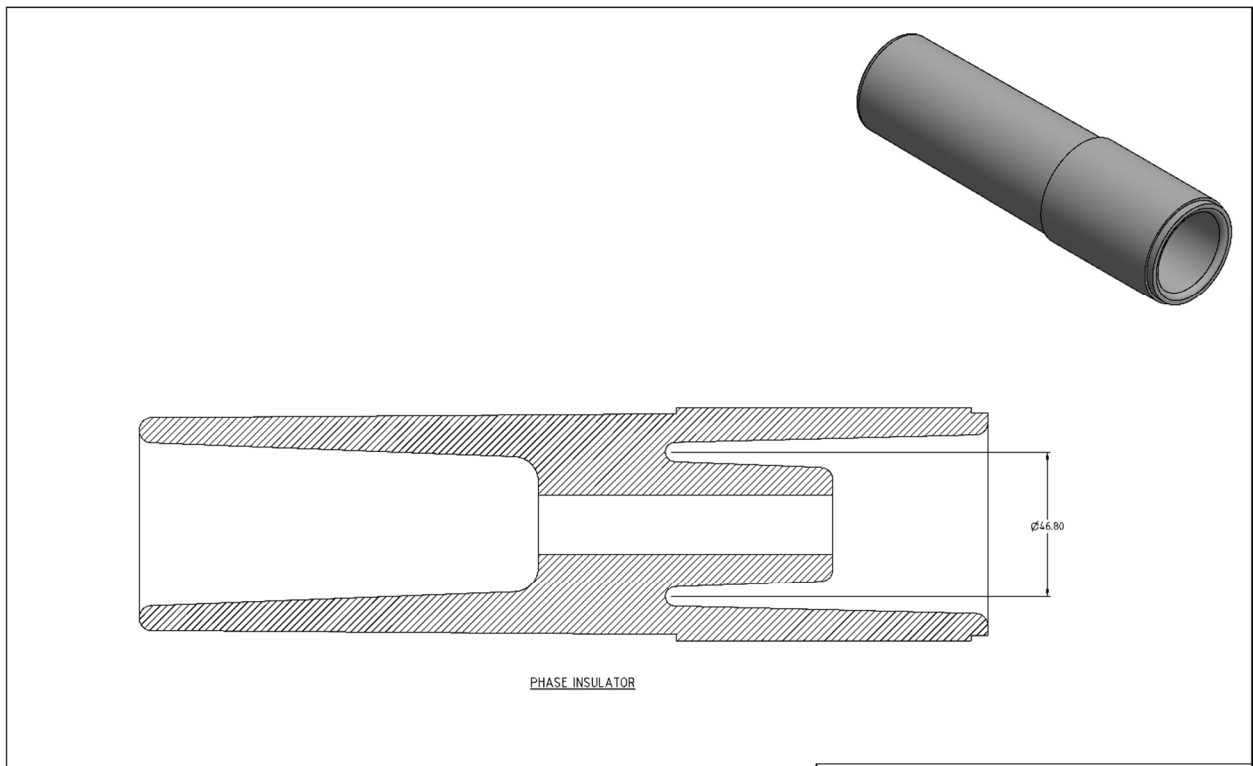
AusProof PTY LTD		DESIGNED BY C. Taylor	PART NAME 22 kV Assembly Exploded View	SURFACE FINISH	
© COPYRIGHT RESERVED		APPROVED BY P.Marks	ISSUE DATE 29/03/2022	REVISION HISTORY	
DIMENSIONS (Metric or Imperial) UNLESS OTHERWISE SPECIFIED ALL SURFACES TO UNLESS OTHERWISE NOTED	X.X 0.1 X.XX 0.02	SHEET 2 OF 8 SIZE A3	DRAWING TITLE (SCALE) PROJECT REFERENCE (If Applicable) PART NO. INZ2CON1	REV	DESCRIPTION
				1	Original
					DATE
					29/03/2022



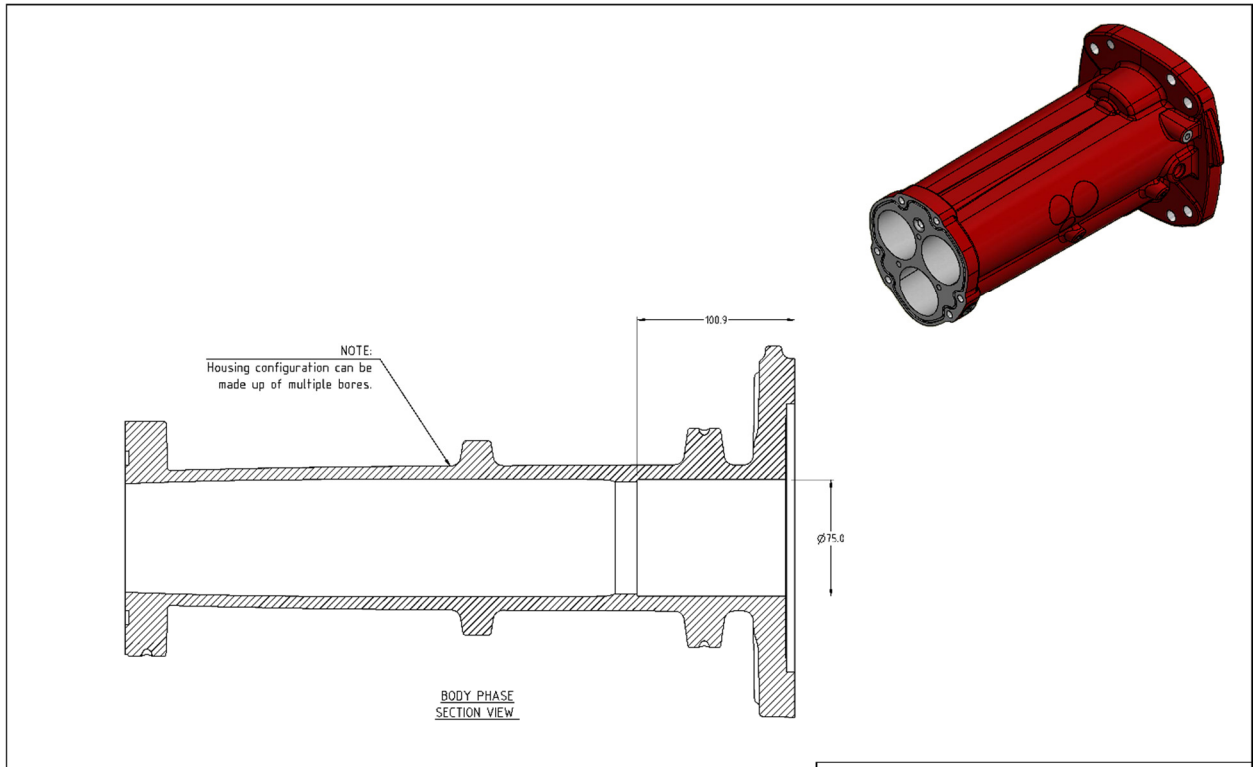
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DIMENSIONS (Metric or Imperial) UNLESS OTHERWISE SPECIFIED ALL SURFACES TO UNLESS OTHERWISE NOTED	X.X 0.1 X.XX 0.05	SHEET 3 OF 8 SIZE A3	DRAWING TITLE (SCALE) PROJECT REFERENCE (If Applicable) PART NO. INZ2CON2	REV	DESCRIPTION
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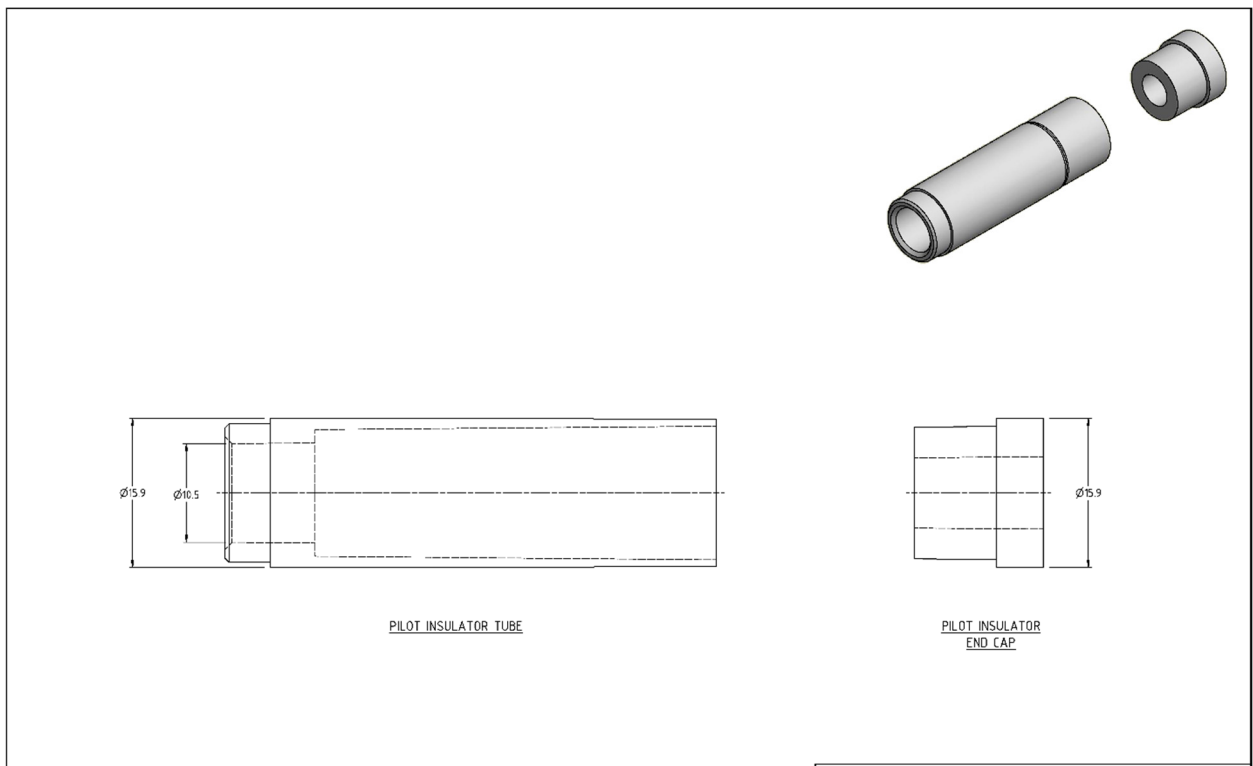
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ALL SURFACES TO UNLESS OTHERWISE NOTED		SIZE A3	PART NO. INZZCON3	1	Original
				DATE	29/03/2022



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DIMENSIONS (Metric or Imperial) UNLESS OTHERWISE SPECIFIED		SCALE 5 OF 8	OPERATING VOLT (kV) ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED	REV	DESCRIPTION
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				DATE	29/03/2022



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DIMENSIONS (Marked otherwise) UNLESS OTHERWISE SPECIFIED		SCALE 7 OF 8	DATE 29/03/2022	ISSUE NO. INZCC06	DESCRIPTION	DATE
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