Procurement Engineering Standard Purchase Clause	
Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spares parts

1.0 QUALIFICATION BY TEST AND ANALYSIS

This EQPR is intended to be used when buying **electrical cables** manufactured by **Rockbestos-Surprenant** (hereinafter Rockbestos) for use throughout Ontario Power Generation (hereinafter OPG) Nuclear sites in safety-related applications which require to be environmentally qualified (EQ).

Rockbestos item shown in the OPG purchase order (P.O.) item description has been assessed and environmentally qualified by the OPG Engineer (see the Contract Standard for definition of "Engineer") for use in nuclear safety-related applications based on the test reports listed below:

Cable Type/Description	Rockbestos Test Report
300V Control Cable	**QR-5805, R002,** dated 2 July, 1987
600V Control Cable	
600V Control Cable (Armoured)	
600V & 1000V Power Cable (Armoured)	
600V & 1000V Power Cable (Unarmoured)	
600V Hook-up Wire	
300V Shielded Pairs and Triads Instrumentation Cable	
300V Hook-up Wire	
RSS-6-108F/LE Double Shielded Coaxial (Triaxial)	**QR-6802, R002**, "*Report on Qualification Test for Rockbestos Adverse Service Coaxial, Twin axial, and Triaxial Cable Generic Nuclear Incident for Class 1E Service in Nuclear Generating Stations*", dated 12 July, 1990.
RSS-6-111F/LE Cable, Coaxial, 18 AWG Tinned Copper Conductor, 34 AWG Tinned Copper Braid Shield, w/ XLPO Insulation, FRXLPO 1st Jacket, and CSPE KH-131 2nd Jacket, Nuclear Class 1E	▪ Rockbestos drawing # **TD-005259** ▪ **QR-6802, R002**, "*Report on Qualification Test for Rockbestos Adverse Service Coaxial, Twin axial, and Triaxial Cable Generic Nuclear Incident for Class 1E Service in Nuclear Generating Stations*", dated 12 July, 1990.
FF08500-000, Cable, Fiber Optic, EQ, 8 radiation resistant 50/125µm multimode fibers, 2 concentric layers of acrylate coating, stainless steel (SS) tube (Type 316 stainless steel (SS)), helically stranded wire armor (SWA) (13 type 316 stainless steel (SS) armor wires).	▪ **QR-1701, R000** - Qualification Of RSCC® EQ Fiber Optic Cable For Nuclear Incident Class 1E Service In Nuclear Generating Power Stations In Accordance With The Requirements Set Forth In OPG Specification NK38-TS-68000-10018-R001 ▪ Rockbestos drawing: **RS-DNS-5409**

Note: *Report Document No.: **TR-1008, R00** – "Test Report CSPE Like for Like Replacement", prepared by: Rockbestos Company, Dated: August 23, 2010 and accepted by OPG, documents replacement of the Hypalon cable jacket with CSPE cable jacket.*

Rockbestos cables shall comply with OPG technical specifications listed below:

Cable Type/Description	Ontario Power Generation Specification No.
300V, Control Cable	N-TSE-57100-10000,R02
600V, Control Cable	N-TSE-57100-10001,R01
600V, Control Cable (Armoured)	N-TSE-57100-10023,R00
600V & 1000V, Power Cable (Unarmoured)	N-TSE-57100-10002,R01
600V & 1000V, Power Cable (Armoured)	N-TSE-57100-10003,R00
600V, Hook-up Wire	N-TSE-57100-10008,R01

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Cable Type/Description	Ontario Power Generation Specification No.
300V, Shielded Pairs and Triads Instrumentation Cable	N-TSE-57100-10004,R01
RSS-6-108F/LE Double Shielded Coaxial (Triaxial)	N-TSE-57100-10010,R00
300V, Hook-up Wire	N-TSE-57100-10025,R00
RSS-6-111F/LE Coaxial Cable - modified from Model # RSS-6-111C/LE through the addition of a Mechanically Protective Jacket and Barrier	NK38-TSE-57100-10001,R00

The following exceptions and clarifications to OPG Technical Specifications are noted and concurred/accepted by Sr. Manager, Plant Design Engineering, OPG (see N-PPS-03651-10061 sheet EQPR, R08 dated Jun 2005).

For further exceptions and clarifications to OPG Technical Specifications referenced below, OPG Design acceptance/concurrence is required on the cover page of the EQPR revision.

OPG Specification: N-TSE-57100-10000, R002 **Control Cable – 300V Shielded, No. 16 AWG, Solid Conductor, Nuclear Grade**	
Paragraph	**Exceptions and Clarifications**
3.1	The QA requirements outlined in Clause 3.1 of Specification N-TSE-57100-10000 R02 are replaced in their entirety by those outlined in Section 4 of this EQPR.
6.1.4.1	The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
6.1.5.3	When supplying 50 pair cable, the construction lay-up shall consist of 3-9-13-25 pairs. The inner 25 pairs will be the first binder group. The outer 25 pair shall be the second binder group. The first binder group shall be bundled with an orange coloured binder tape. The outer binder group shall be bundled with a blue coloured binder tape.
6.1.5.4.2	Fillers, if used, shall have no deleterious effects on other cable components. The filler shall meet the requirements of Clause 6.4.16 of CSA Standard C22.2 No. 38 when tested in accordance with the method and apparatus of Clause 4.29 of CSA Standard C22.2 No. 0.3. In addition, the minimum melting temperature of the filler shall not be less than 171 ^{o}C.
6.1.6.1	Rockbestos shall supply an inner protective covering consisting of a rubberised fabric tape 0.25 mm thick in lieu of an extrusion.
6.1.7.2	Rockbestos shall supply a solid drain wire as specified in the Ontario Power Generation's Specification N-TSE-57100-10000, R02 except there is no drain wire on 1 pair and 2 pair cable.
6.1.8.3	For cables with more than two pairs, Rockbestos shall supply a single 0.13mm nominal, thick copper tape with a nominal 25% overlap.
6.1.9.2	The overall jacket material shall be-mould cured Hypalon™, thermosetting material with an acid gas content not exceeding 14%. Rockbestos shall take appropriate steps, if required, to prevent the Hypalon™ jacket from oxidising/corroding the copper shield of Clause 6.1.8 of N-TSE-57100-10000 R02 during the jacket curing process. For the one and two pair cable construction, a Furon™ WC340 (Kapton) tape (a 0.025 mm thick polyimide backing material with a 0.025 mm silicone pressure sensitive adhesive on one side) shall be applied between the braided shield and the outer jacket to impart the necessary FT4 fire retardant properties to the cable. Kapton tape may be deleted provided that it is demonstrated that the cable can continue to pass the FT4 flame test.
6.1.10.1	Rockbestos shall supply solid coloured conductors as specified in Ontario Power Generation's Specification N-TSE-57100-10000, R02 together with printing of the colour name on the insulation. The colour name shall repeat along the length of the insulated conductor at a maximum centre to centre spacing not exceeding 80 mm. The colour of the ink shall clearly contrast with the cable insulation colour, and the printing height shall be large enough. The colour names shall be clearly legible by normal or corrected-to-normal vision when viewed at a distance of not less than 50cm.

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OPG Specification: N-TSE-57100-10000, R002
Control Cable – 300V Shielded, No. 16 AWG, Solid Conductor, Nuclear Grade

Paragraph	Exceptions and Clarifications
6.2	The characters “NUCLEAR - EQ” shall be printed on the jacket in lieu of the word “NUCLEAR”. The information to be printed on the outer cable jacket is amended as outlined per Section 6 of this EQPR. The print information of Clauses 6.2.2 and 6.2.3 of N-TSE-57100-10000 R02 and Section 6 of this EQPR shall be printed on one side of the cable.
6.2.2	The actual length of the cable shall be within ± 2% of the indicated length provided by the jacket markings.
6.2.4	The letter height shall be large enough to ensure that the printed markings are crisp and clear (legible) when viewed with normal or corrected-to-normal vision at a distance of not less than 1 metre.
7.2.3.4.2.3	Perform only on un-aged samples.
7.2.4.3	Required as a type test.
7.2.4.6	Each reel shall be tested and conductors shall be randomly chosen for testing. The following sample frequency shall be used: -At least one conductor shall be tested, and -At least 10% of the conductors shall be tested.
7.2.4.7	Required as a type test.
7.2.4.11 (New)	Flexure test / to be performed as a type test, on all different sizes of cable construction. A sample of the completed cable shall be flexed whilst under tension, by either of the two methods shown in Section 1 of this EQPR. The pulley diameter shall not be more than 14 times the diameter of the cable sample tested. For cables with an overall diameter of less than 32.5 mm, the tensile load (F) shall be 125 N, and the cable shall pass through the pulley(s) for four (4) cycles. For cables with an overall diameter of over 32.5 mm, the tensile load shall (F) be 250 N, and the cable shall pass through the pulley(s) for two (2) cycles. After the cable has been tested, the cable shall be examined for evidence of poor design and workmanship. A visual examination of the copper shield shall also be performed. The shield shall not exhibit any fractures. Any change to the cable construction (e.g., number of conductors, size of conductors, changes to the copper shield foil (width, thickness, material, overlap, lay length, manufacturing processes)) that would change the cable design would require a new cable flexing test.
8.3.3	The information to be printed on the reel shall be as indicated in Ontario Power Generation’s Specification N-TSE-57100-10000, R02 and amended as outlined in Section 7 of this EQPR.
8.5.2	For shipment, the cable ends shall be durably sealed against the entrance of moisture with heat shrinkable end caps. In addition, during storage, and each time after some cable has been issued, WE will install a reusable end cap on the cable end. For this purpose, Rockbestos is to supply one reusable end cap with each reel of cable.

OPG Specification: N-TSE-57100-10001, R001
Control Cable - 600V, Overall Shielded or Unshielded, Stranded Conductor, Environmentally Qualified

Paragraph	Exceptions and Clarifications
3.0	The QA requirements outlined in Clauses 3.0 to 3.2 of Specification N-TSE-57100-10001 R01 are replaced in their entirety by those outlined in Sections 4 and 5 of this EQPR
6.1.4.1	The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
6.1.5.2.2.3	Filler if used shall have a minimum melting temperature of 171 ^{o}C.
6.1.6.3.2.1	Rockbestos shall supply an inner protective covering consisting of a rubberised fabric tape 0.25 mm thick in lieu of an extrusion.

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OPG Specification: N-TSE-57100-10001, R001 **Control Cable - 600V, Overall Shielded or Unshielded, Stranded Conductor, Environmentally Qualified**	
Paragraph	**Exceptions and Clarifications**
6.1.6.3.3	The drain wire shall be stranded and same or more flexible stranding class than the conductor. For conductor sizes: • Equal to or smaller than 19 AWG, the drain wire shall be 19 AWG. • 18 AWG, the drain wire shall be 18 AWG. • Greater than or equal to 16 AWG, the drain wire shall be 16 AWG.
6.1.7.2	Kapton tape may be deleted provided that it is demonstrated that the cable can continue to pass the FT4 flame test.
6.2.2.1	The print information of Clause 6.2.1 of N-TSE-57100-10001 R01 and Section 6 of this EQPR shall be printed on one side of the cable.
8.3.3	The reel shall be printed as per the Ontario Power Generation's Specification N-TSE-57100-10001, R01. The information to be marked on the reel is amended as outlined in Section 7 of this EQPR.
8.5.2	For shipment, the cable ends shall be durably sealed against the entrance of moisture with heat shrinkable end caps. In addition, during storage, and each time after some cable has been issued, WE will install a reusable end cap on the cable end. For this purpose, Rockbestos is to supply one reusable end cap with each reel of cable.
D.17.3	A visual examination of the copper shield shall also be performed. The shield shall not exhibit any fractures, creases, crinkles or be deformed.

OPG Specification: N-TSE-57100-10002, R001 **Power Cable, 600V, Environmentally Qualified** ***Applies to un-armoured 600V and 1000V cables**	
Paragraph	**Exceptions and Clarifications**
3.0	The QA requirements outlined in Clauses 3.0 to 3.2 of Specification N-TSE-57100-10002 R01 are replaced in their entirety by those outlined in Sections 4 and 5 of this EQPR.
6.1.3.3	A solid conductor option shall be permitted for the 4 conductor, #12 AWG cable (Catalogue ID 476563-1), complying with the appropriate requirements of ASTM Standards B3 and B33.
6.1.4	Although the specification allows a separator. Rockbestos cable shall be provided without a separator.
6.1.5	The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
6.1.6	Un-armoured cable shall be supplied without bonding conductor.
6.1.7.4	Filler if used shall have a minimum melting temperature of not be less than 171°C.
6.1.8	Rockbestos cable shall be supplied with the optional separator.
6.1.9.2	The overall jacket shall be a radiation resistant Hypalon™, thermosetting material with an acid gas content not exceeding 14%. Kapton tape may be deleted provided that it is demonstrated that the cable can continue to pass the FT4 flame test.
6.1.10.2	Coloured insulation shall be used to identify the conductors.
8.3.3	The reel shall be printed as per the Ontario Power Generation's Specification N-TSE-57100-10002, R01. The notation indicating that cable shall be warmed above 10°C before flexing and the minimum bend radius will be added as indicated in Section 7 of this EQPR.
8.5.2	In addition, during storage, and each time after some cable has been issued, WE will install a reusable end cap on the cable end. For this purpose, Rockbestos is to supply one reusable end cap with each reel of cable.

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Applicable to:	Safety Related and EQ Items and spares parts

OPG Specification: N-TSE-57100-10003, R000 **Nuclear Grade, Armoured Power Cable, 600V - 1000V, For Use In Generating Stations**	
Paragraph	**Exceptions and Clarifications**
1.2	The cable shall not contain asbestos or PVC materials. In addition, the materials used (insulation, binder tape, jacket, fillers, adhesives, inks, lubricants, etc.) shall not have any deleterious effects on each other, and shall be suitable for the life of the cable (40 years), at 75°C. Gardex continuously welded aluminium armoured shall be supplied in lieu of continuously interlock aluminium armour.
6.1	The stranded conductors shall be left-hand lay, and comply with the appropriate requirements of ASTM Standards B3, B8, and B33.
6.1.1	The cross sectional area of the conductor shall not be less than the values tabulated in Table 4 of CSA Standard C22.2 No. 38 when measured in accordance with the apparatus and procedures of Clause 4.1.1 of CSA Standard C22.2 No. 0.3.
6.2	The temperature rating of the thermosetting insulation shall be 90°C or higher dry and 75°C or higher wet. The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
6.3	Replace contents of Clauses 6.3 and 6.3.1 with the following Clauses: 6.3.1 Single Conductor Cables The minimum size of the bonding conductors on single conductor cables shall comply with the requirements of Table 1 of CSA Standard C22.2 No. 131. The bonding conductor shall consist of a serving of helically applied uninsulated copper wires, complying with the requirements of Clause 4.2.3 of CSA Standard C22.2 No. 131. In addition, a No. 26 AWG or larger copper reverse wire shall be applied helically over, and in intimate contact with the concentric bonding wires.
	6.3.2 Multi-Conductor Cables 6.3.2.1 General The multiple conductor cable shall have the finished insulated conductors and bare copper bonding conductors cabled together. The bonding conductors shall comply with the requirements of Table 1 of CSA Standard C22.2 No. 131.
	6.3.2.2 Cable Lay 6.3.2.2.1 General The cable length of lay shall not exceed the values tabulated in Table 5 of CSA Standard C22.2 No.131.
	6.3.2.2.2 Lay Reversals If the manufacturer is able to manufacture the required cable lengths without any lay reversals, the cable lay shall be left hand lay. If lay reversals are required, the direction of lay may be changed at intervals throughout the cable in accordance with the requirements of Clause 4.6 of CSA Standard C22.2 No. 131.
	6.3.3 Cross Section The overall cross section of the finished assembly shall form basically a circular cross section of the cable
	6.3.4 Fillers Fillers, if used, shall have no deleterious effects on other cable components, and shall be located in the outer interstices of the multiple-conductor cable. The filler shall meet the requirements of Clause 6.4.16 of CSA Standard C22.2 No. 38 when tested in accordance with the method and apparatus of Clause 4.29 of CSA Standard C22.2 No. 0.3. In addition, the minimum melting temperature of the filler shall not be less than 171°C.
6.4	Replace contents of Clause 6.4 with the following Clauses: 6.4.1 General Over single or multiple conductor assemblies, at least one bonding conductor shall be included as specified in Clause 4.2 of CSA Standard C22.2 No. 131.

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OPG Specification: N-TSE-57100-10003, R000
Nuclear Grade, Armoured Power Cable, 600V - 1000V, For Use In Generating Stations

Paragraph	Exceptions and Clarifications
	6.4.2 Bonding Conductor Material The bonding conductor(s) shall be annealed, tin coated, stranded copper, and shall comply with the appropriate parts of ASTM Standard B8 and B33. The bonding conductor(s) shall be of the same or more flexible stranding class as that of the accompanying stranded circuit conductors. 6.4.3 Bonding Conductor Size The bonding conductor size(s) shall not be smaller than the sizes tabulated in Table 1 of CSA Standard C22.2 No. 131. The conductor size shall be determined to comply with the requirements (area/diameter) of Table 4 of CSA Standard C22.2 No. 38 when measured with the apparatus and method of Clause 4.1.1 of CSA Standard C22.2 No. 0.3.
6.5	The separator shall be a polyester binder tape over the cable assembly complying with the requirements of Clause 4.4.9 of CSA Standard C22.2 No. 38.
6.6	The outer jacket shall be a radiation resistant Hypalon™, thermosetting material with an acid gas content not exceeding 14%. The average jacket thickness and minimum thickness at any point shall be measured in accordance with the apparatus and methods of Clause 4.2.8 of CSA Standard C22.2 No. 0.3. The single conductor cable inner jacket thickness shall comply with the values tabulated in Table 5 of CSA Standard C22.2 No. 131. The multi-conductor cable inner jacket thickness shall comply with the values tabulated in Table 6 of CSA Standard C22.2 No. 131.
6.7	The Gardex continuously welded aluminium armour shall pass the following production tests as per CSA Standard C22.2 No. 123: Gardex Armour flexibility: Gardex armour flexibility shall pass the test of Clause 6.2.1 of CSA Standard C22.2 No. 123, when tested in accordance with the apparatus and methods of Clause 4.19.2 of CSA Standard C22.2 No. 0.3. Interior surface: the interior surface shall be free from burrs and sharp edges that are a potential cause of abrasion of the cable assembly when tested in accordance with the procedures and method of Clause 4.21 of CSA Standard C22.2 No. 0.3.
	Tensile Strength: the Gardex continuously welded aluminium armour shall pass the test of Clause 4.3.1.1.1 of CSA Standard C22.2 No. 174 when tested in accordance with the apparatus and method of Clause 4.17 of CSA Standard C22.2 No. 0.3. Tightness of Gardex continuously welded Aluminium Armour - the armour shall grip the cable sufficiently that it meets the requirements of the test of Clause 5.12.1 of CSA Standard C22.2 No. 51, when tested in accordance with the method and apparatus of Clause 4.18 of CSA Standard C22.2 No. 0.3. The armour shall not be too tight and shall pass test requirement of Clause 5.15.1 of CSA Standard C22.2 No. 51 when tested in accordance with the apparatus and method of Clause 4.20 of CSA Standard C22.2 No. 0.3.
6.8.1	The overall jacket shall be a radiation resistant Hypalon™, thermosetting material with an acid gas content not exceeding 14%. The jacket thickness shall be measured in accordance with the apparatus and method described in Clause 4.2.8 of CSA Standard C22.2 No. 0.3. The minimum thickness at any point shall not be less than the minimum jacket thickness tabulated in Table 16 of CSA Standard C22.2 No. 131.

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OPG Specification: N-TSE-57100-10003, R000 **Nuclear Grade, Armoured Power Cable, 600V - 1000V, For Use In Generating Stations**	
Paragraph	**Exceptions and Clarifications**
6.9.2	Conductor colour identification for cables with 3, 4, or 5 conductors shall be as per Ontario Power Generation's Specification N-TSE-57100-10003, R00. Unless otherwise specified in the purchasing documents, the conductors of 2 conductor cables shall be coloured black and white. The insulation colour of single conductor cables may be red, blue, black, white or green as specified in N-TSE-57100-10003, R00. Conductors of cables with more than 5 conductors shall be identified with number coding. The printing ink and the cable components shall not have any deleterious effect on each other; there shall be no fading, cracking or blurring. The insulation colour shall be black. Each conductor shall be clearly marked along the length of the cable. The printing colour shall contrast clearly with the background colour. The printing shall be well defined, legible and not indented. The centre to centre spacing of the marks on each conductor shall not exceed 100 mm. The printing height shall be large enough to be clearly legible with normal or corrected to normal vision. Each number marking shall consist of the number both in written English and the Arabic numeral. The Arabic numeral should precede the written number, e.g., "1 - ONE", "2 - TWO", "3 - THREE", "4 - FOUR", and so on. The printing, when examined after the test described by CSA Standard C22.2 No. 0.3 Clause 4.32, shall be legible.
8.1	The characters "NUCLEAR - EQ" shall be printed on the jacket in lieu of the word "Nuclear". The information to be printed on the outer cable jacket is amended as outlined per Section 6 of this EQPR The print information of Clause 8.1 of N-TSE-57100-10003 R00 and Section 6 of this EQPR shall be printed on one side of the cable.
9.0	For shipment, the cable ends shall be durably sealed against the entrance of moisture with heat shrinkable end caps. In addition, during storage, and each time after some cable has been issued, WE will install a reusable end cap on the cable end. For this purpose, Rockbestos is to supply one reusable end cap with each reel of cable.
9.2.1	The reel shall be printed as per the Ontario Power Generation's Specification N-TSE-57100-10003, R00. The information to be marked on the reel is amended as outlined in Section 6 of this EQPR.
10.1	The QA requirements outlined in Clause 10.1 of Specification N-TSE-57100-10003 R00 are replaced in their entirety by those outlined in Section 4 of this EQPR.
10.3.2	If a failure occurs during the spark test the insulation may not be repaired. Repairs and splices to the insulation are not permitted within the finished length of the cable.

OPG Specification: N-TSE-57100-10004, R001 **Instrumentation Cable, 300V, Twisted Pairs or Triads, Overall & Individually Shielded, Stranded Conductor, Environmentally Qualified**	
Paragraph	**Exceptions and Clarifications**
3.1	The QA requirements outlined in Clause 3.1 of Specification N-TSE-57100-10004 R01 are replaced in their entirety by those outlined in Section 4 of this EQPR.
6.1.1	In addition, the materials used (insulation, binder tape, jacket, fillers, adhesives, inks, lubricants, etc.) shall not have any deleterious effects on each other, and shall be suitable for the life of the cable (40 years), at 75°C.
6.1.4.1 6.1.4.2	The insulation shall be rated for 90°C or higher dry, and 75°C or higher wet. The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
6.1.5.1 6.1.5.2.1	The completed cable shall consist of one or more twisted pairs or triads. Each pair/triad is individually shielded (with individual drain wire) and then supplied with its own insulating jacket. These pair/triad assemblies are cabled together, and then provided with an overall shield (and drain wire) and jacket.

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OPG Specification: N-TSE-57100-10004, R001

Instrumentation Cable, 300V, Twisted Pairs or Triads, Overall & Individually Shielded, Stranded Conductor, Environmentally Qualified

Paragraph	Exceptions and Clarifications
6.1.5.2.2	To minimise electrical noise, adjacent conductor pair/triad lays shall be staggered with a lay not exceeding 100 mm.
6.1.5.2.3	Individual pairs/triads: A polyester tape or equivalent wrap, complying with the requirements of Clause 4.4.9 of CSA Standard C22.2 No. 38, shall be applied, without creases and folds, over the pair/triad. Overall cable: The lay length used to cable together the individually jacketed pair/triad assemblies shall not exceed 15 times the finished cable OD. A polyester tape or equivalent wrap, complying with the requirements of Clause 4.4.9 of CSA Standard C22.2 No. 38, shall be applied, without creases and folds, over the cabled individually jacketed pair/triad assemblies.
6.1.5.2.4	Individual pairs/triads: The drain wire shall be tin coated and applied over the individual pair/triad binder tape of Clause 6.1.5.2.3. Overall cable: The drain wire shall be tin coated, solid #16 AWG applied over the binder tape of the cabled pair/triad assemblies of Clause 6.1.5.2.3.
6.1.5.2.4.3	For conductor sizes: • Equal to or smaller than 19 AWG, the drain wire shall be 19 AWG. • 18 AWG, the drain wire shall be 18 AWG. • Greater than or equal to 16 AWG, the drain wire shall be 16 AWG.
6.1.5.2.5	Individual pairs/triads: The shield shall consist of a copper metallized polyester tape, at least 0.025 mm thick with a coating of copper on one side at least 0.018 mm thick. The tape shall be applied, with the copper side facing inwards and in intimate contact with the drain wire. The applied tape shall not exhibit any folds or creases.
6.1.5.2.6	Individual pairs/triads: The individual pair/triad jacket material shall be radiation cross-linked polyethylene XLPE (KXL-760 G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987. The overall jacket material for the 50 pair cable shall be-mould cured Hypalon™, thermosetting material with an acid gas content not exceeding 14%. Rockbestos shall take appropriate steps, if required, to prevent the Hypalon™ jacket from oxidising/corroding the shields of Clause 6.1.5.3.5 of N-TSE-57100-10004 R01 during the jacket curing process(es).
6.1.5.3.3.3	Fillers, if used, shall have no deleterious effects on other cable components. The filler shall meet the requirements of Clause 6.4.16 of CSA Standard C22.2 No. 38 when tested in accordance with the method and apparatus of Clause 4.29 of CSA Standard C22.2 No. 0.3. In addition, the minimum melting temperature of the filler shall not be less than 171 ^{o}C.
6.1.5.3.5.2.	The braided shield, if used, shall be in intimate contact with the drain wire.
6.1.5.3.5.3	Overall cable: The copper tape shield, if used, shall consist of a single 0.12 mm thick copper tape, helically applied with a 25% overlap and in intimate contact with the overall drain wire.
6.1.5.3.7.2	Kapton tape may be deleted provided that it is demonstrated that the cable can continue to pass the FT4 flame test.

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Title:	**EQPR FOR ROCKBESTOS CABLES R018**
Applicable to:	Safety Related and EQ Items and spares parts

OPG Specification: N-TSE-57100-10004, R001

Instrumentation Cable, 300V, Twisted Pairs or Triads, Overall & Individually Shielded, Stranded Conductor, Environmentally Qualified

Paragraph	Exceptions and Clarifications
6.1.6.3	Rockbestos shall supply solid coloured conductors as specified in Ontario Power Generation's Specification N-TSE-57100-10004, R01 together with printing of the colour name on the insulation for only slate and black when both colours are included in the cable construction. The colour name shall repeat along the length of the insulated conductor at a maximum centre to centre spacing not exceeding 80 mm. The colour of the ink shall clearly contrast with the cable insulation colour, and the printing height shall be large enough. The colour names shall be clearly legible by normal or corrected-to-normal vision.
6.1.6.4	Each conductor shall be clearly marked along the length of the cable. The printing colour shall contrast clearly with the background colour. The printing shall be well defined, legible and not indented. The centre to centre spacing of the marks on each conductor shall not exceed 30 mm. The printing height shall be large enough to be clearly legible with normal or corrected to normal vision. Each triad conductor shall be printed with its' numeric triad number only. These numbers shall have a line underneath them, and shall be alternately reversed. The printing, when examined after the test described by CSA Standard C22.2 No.0.3 Clause 4.32, shall be legible.
6.2.2.3	The characters "NUCLEAR – EQ" shall be printed on the jacket in lieu of the word "Nuclear". The information to be printed on the outer cable jacket is amended as outlined per Section 6 of this EQPR The print information of Clause 6.2.2.3 of N-TSE-57100-10004 R01 and Section 6 of this EQPR shall be printed on one side of the cable.
7.3.3.3.5.3	If a failure occurs during the spark test the insulation may not be repaired. Repairs and splices to the insulation are not permitted within the finished length of the cable. Repairs and splices to the individual triad/twisted pair inner jackets are not permitted.
8.3.3	The information to be printed on the reel shall be as indicated in Ontario Power Generation's Specification N-TSE-57100-10004, R01 and amended as outlined in Section 7 of this EQPR.
8.5.2	For shipment, the cable ends shall be durably sealed against the entrance of moisture with heat shrinkable end caps. In addition, during storage, and each time after some cable has been issued, WE will install a reusable end cap on the cable end. For this purpose, Rockbestos is to supply one reusable end cap with each reel of cable.
D.17	Flexure Test / to be performed as a type test on the smallest and largest cable construction only. A sample of the completed cable shall be flexed whilst under tension, by either of the two methods shown in Section 1 of this EQPR. The pulley diameter shall not be more than 14 times the diameter of the cable sample tested. For cables with an overall diameter of less than 32.5 mm, the tensile load (F) shall be 125 N, and the cable shall pass through the pulley(s) for four (4) cycles. For cables with an overall diameter of over 32.5 mm, the tensile load shall (F) be 250 N, and the cable shall pass through the pulley(s) for two (2) cycles. After the cable has been thus tested, the cable shall be examined for evidence of poor design and workmanship. A visual examination of the copper shields shall also be performed. The shields shall not exhibit any fractures. Any changes to the cable construction {e.g., number of conductors, size of conductors, changes to the copper shield foil (width, thickness, material, overlap, lay length, manufacturing processes)} that would change the cable design would require a new cable flexing test.

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spares parts

OPG Specification: N-TSE-57100-10008, R001 **Hook-up Wire, 600V, Stranded or Solid Conductor, Environmentally Qualified**	
Paragraph	**Exceptions and Clarifications**
3.1	The QA requirements outlined in Clause 3.1 of Specification N-TSE-57100-10008 R01 are replaced in their entirety by those outlined in Section 4 of this EQPR.
6.1.1	In addition, the materials used (insulation, inks, lubricants, etc.) shall not have any deleterious effects on each other, and shall be suitable for the life of the hook-up wire (40 years), at 75°C.
6.1.4.1	The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
6.1.4.2	The insulation shall be rated for 90°C or higher dry, and 75°C or higher wet.
6.1.4.3	The average insulation thickness shall be not less than the minimum average values tabulated in Table 5 of CSA C22.2 No. 239. The minimum insulation thickness, at any point, shall not be less than 90 percent of the minimum average value.
6.1.5	A typical twisted pair application would be for CFD jumpers for instrument signals. If twisted pair hook-up wires are specified in the purchasing documents, two insulated conductors shall be twisted together with a lay of 35 to 75 mm. Binder tapes, outer jackets, or similar coverings are not permitted over the twisted pairs.
6.1.6.3	For twisted pair hook-up wires, the insulation from each conductor shall be coloured differently (e.g., black and white), as specified in the purchasing documents. The shade of the solid colours shall be such that they will maintain a definite contrast between each other when illuminated by a source providing an illuminance of 100 decalux (1000 lux).
6.1.7.2	The characters “NUCLEAR - EQ” shall be printed on the wire in lieu of the word “Nuclear”. The information to be printed on the wire is amended as outlined per Section 6 of this EQPR. The print information of Clause 6.1.7.2 of N-TSE-57100-10008 R01 and Section 6 of this EQPR shall be printed on one side of the wire.
6.1.7.3	The letter height printed on the insulation shall be large enough to be clearly legible by normal or corrected-to-normal vision when viewed at a distance of not less than one metre.
7.3.3.3.5.3	If a failure occurs during the spark test the insulation may not be repaired. Repairs and splices to the insulation are not permitted within the finished length of the cable.
8.3.3	The reel shall be printed as per the Ontario Power Generation’s Specification N-TSE-57100-10008, R01. The information to be marked on the reel is amended as outlined in Section 7 of this EQPR.
8.5	The wire ends shall be durably sealed against the entrance of moisture. Both wire ends shall be secured in a manner that will ensure that the integrity of the hook-up wire and the sealing system is maintained (e.g., permanently installed heat shrunk end caps).

OPG Specification: N-TSE-57100-10010, R000 **Coaxial Cable - 1000V, Nuclear Grade** ***Applies to Rockbestos RSS-6-108F/LE Coaxial Cable**	
Paragraph	**Exceptions and Clarifications**
3.1	The QA requirements outlined in Clause 3.1 of Specification N-TSE-57100-10010 R00 are replaced in their entirety by those outlined in Section 4 of this EQPR.
6.1.1	In addition, the materials used (insulation, binder tape, jacket, fillers, adhesives, inks, lubricants, etc.) shall not have any deleterious effects on each other, and shall be suitable for the life of the cable (40 years), at 75°C.

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spares parts

OPG Specification: N-TSE-57100-10010, R000
Coaxial Cable - 1000V, Nuclear Grade
***Applies to Rockbestos RSS-6-108F/LE Coaxial Cable**

Paragraph	Exceptions and Clarifications
6.1.3	The cable consists of two insulation layers: The first insulation shall be a high temperature dielectric KLE-633 polymer as per Rockbestos Test Report QR-6802, Rev. 02, dated July 12, 1990. The second insulation shall be a radiation cross-linked, low noise treated modified polyolefin (KXL-100) as per Rockbestos Test Report QR-6802, Rev. 02, dated July 12, 1990.
6.1.6	The cable consists of 3 jackets: 1. The first jacket shall be a radiation cross-linked flame retardant, non-corrosive polyolefin (KXL-200) as per Rockbestos Test Report QR-6802, Rev. 02, dated July 12, 1990. 2. The second jacket material shall be a radiation cross-linked flame retardant, non-corrosive polyolefin (KXL-200) as per Rockbestos Test Report QR-6802, Rev. 02, dated July 12, 1990. 3. The third jacket material shall be mould cured Hypalon™(chlorosulfonated polyethylene (CSPE)), KH-131 thermosetting material, with an acid gas content not exceeding 14%. A fire-retardant mica-glass tape shall be applied between the second jacket and the third jacket. Kapton tape may be deleted provided that it is demonstrated that the cable can continue to pass the FT4 flame test.
6.2.2	The characters “NUCLEAR - EQ” shall be printed on the jacket in lieu of the word “Nuclear”. The information to be printed on the outer cable jacket is amended as outlined per Section 6 of this EQPR. The print information of Clause 6.2.2 of N-TSE-57100-10010 R00 and Section 6 of this EQPR shall be printed on one side of the cable.
7.3.1	The information to be printed on the reel shall be as indicated in Ontario Power Generation’s Specification N-TSE-57100-10010, R00 and amended as outlined in Section 7 of this EQPR.
7.4	For shipment, the cable ends shall be durably sealed against the entrance of moisture with heat shrinkable end caps. In addition, during storage, and each time after some cable has been issued, WE will install a reusable end cap on the cable end. For this purpose, Rockbestos is to supply one reusable end cap with each reel of cable.

OPG Specification: N-TSE-57100-10023, R000
Armoured Control Cable, 600V, Overall Shielded, Stranded Conductor, Environmentally Qualified

Paragraph	Exceptions and Clarifications
3.1	The QA requirements outlined in Clause 3.1 of Specification N-TSE-57100-10023 R00 are replaced in their entirety by those outlined in Section 4 of this EQPR.
6.1.4.1	The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
6.1.5.1	The cable assembly should include one or more bare copper bonding conductors complying with requirements of Clause 4.2 of the CSA Standard C22.2 No. 131.
6.1.5.2.2	The filler shall meet the requirements of Clause 6.4.16 of CSA Standard C22.2 No. 38 when tested in accordance with the method and apparatus of Clause 4.29 of CSA Standard C22.2 No. 0.3. In addition, the minimum melting temperature of the filler shall not be less than 171 ^{o}C.
6.1.6.1	Rockbestos shall supply an inner protective covering consisting of a rubberised fabric tape 0.25 mm thick in lieu of an extrusion.

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spares parts

OPG Specification: N-TSE-57100-10023, R000 **Armoured Control Cable, 600V, Overall Shielded, Stranded Conductor, Environmentally Qualified**	
Paragraph	**Exceptions and Clarifications**
6.1.7	The drain wire shall be stranded and same or more flexible stranding class than the conductor. For conductor sizes: • Equal to or smaller than 19 AWG, the drain wire shall be 19 AWG. • 18 AWG, the drain wire shall be 18 AWG. • Greater than or equal to 16 AWG, the drain wire shall be 16 AWG. It shall be helically applied with a lay not greater than 667 mm, and shall be applied between the inner protective coverings of the cable conductor.
6.1.8.3	The shielding tape that Rockbestos shall supply is a single 0.13mm nominal, thick copper tape, helically applied, with no creases or folds, with a nominal 25% overlap.
6.1.11.2 6.1.13.2	The overall jacket material for the 50 pair cable shall be mould cured Hypalon™, thermosetting material with an acid gas content not exceeding 14%. Rockbestos shall take appropriate steps, if required, to prevent the Hypalon™ jacket from oxidising/corroding the copper shield of Clause 6.1.8 of N-TSE-57100-10023 R00 during the jacket curing process.
6.1.12.1	Gardex continuously welded aluminium armoured shall be supplied in lieu of continuously interlock aluminium armour.
6.2.2.3	The information to be printed on the outer cable jacket is amended as outlined per Section 6 of this EQPR
7.3.4.12	Cable Flexing Test is to be performed as a type test, as described in Section 10. of this EQPR. Any changes to the cable construction (e.g., number of conductors, size of conductors, changes to the copper shield foil (width, thickness, material, overlap, lay length, manufacturing processes) that would change the cable design would require a new cable flexing test.
7.3.4.5	Each reel shall be tested and conductors shall be randomly chosen for testing. The following sample frequency shall be used: -At least one conductor shall be tested, and -At least 10% of the conductors shall be tested.
7.3.4.6	Required as a type test.
7.3.4.8	Required as a type test.
8.3.3	The information to be marked on the reel is amended as outlined in Section 7 of this EQPR.
8.5.2	For shipment, the cable ends shall be durably sealed against the entrance of moisture with heat shrinkable end caps. In addition, during storage, and each time after some cable has been issued, WE will install a reusable end cap on the cable end. For this purpose, Rockbestos is to supply one reusable end cap with each reel of cable.

OPG Specification: N-TSE-57100-10025, R000 **Hook-up Wire, 300V, Stranded or Solid Conductor, Environmentally Qualified**	
Paragraph	**Exceptions and Clarifications**
3.0	The QA requirements outlined in Clauses 3.1 to 3.2 of Specification N-TSE-57100-10025 R00 are replaced in their entirety by those outlined in Sections 4 and 5 of this EQPR.
6.1.4.1	The insulation material shall be radiation cross-linked XLPE (KXL-760G) as this is the material that was used on the sample in Rockbestos Qualification Report No. QR-5805 Rev. 02, dated July 2, 1987.
8.3.3	The reel shall be printed as per the Ontario Power Generation's Specification N-TSE-57100-10025, R00. The information to be marked on the reel is amended as outlined in Section 7 of this EQPR.

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spares parts

OPG Specification: NK38-TSE-57100-10001, R000

SDS1 SDS2 and RRS Ion Chamber Coaxial Cable

Note: ***Exceptions and Clarifications as approved by Darlington Design Projects (see EC 81639) apply to Rockbestos RSS-6-111F/LE (CAT ID 617646-1) only***

Paragraph	Exceptions and Clarifications -
2.0	Explicit references to CSA Standards in Sections 4.3.2, 4.3.3, 4.3.5, 4.4.1 and 5.2.1 are deleted. However, production tests shall be conducted by Rockbestos (RSCC) to prove the manufactured cable meets the requirements of this specification. In addition Rockbestos shall provide evidence of compliance with Ontario Electrical Safety Code. ESA approval shall be obtained by Rockbestos for the supplied cable. Evidence of compliance will be a jointly signed (RSCC & ESA) certified test report as required by OPG Purchase Order Contract. OPG will take responsibility for applying the ESA labels to the cable. Rockbestos shall obtain approval through Electrical Safety Authority, 155A Matheson Blvd. W., Suite 204, Mississauga, Ontario L5R 3L5. Call ESA Processing Center at 1-800-559-5356 for a Work Order with Special Instructions.
4.3.2	The first insulation shall be high temperature dielectric (KLE-633) with 0.203 mm (0.008 inch) nominal wall thickness. The insulation shall be rated for continuous operating temperature of 90°C in dry locations and 75°C in wet locations
4.3.3	The second insulation shall be thermoset, low noise treated cross-linked polyolefin (KXL-100) with 2.82 mm (0.111 inch) nominal wall thickness. The insulation shall be rated for a continuous operating temperature of 90°C in dry locations and 75°C in wet locations
4.3.5	The first jacket shall be made of flame retardant, non-corrosive modified polyolefin KXL-200. The thickness of the jacket shall be 1.14 mm (0.045 inch) nominal. The jacket shall be rated for a continuous operating temperature of 90°C in dry locations and 75°C in wet locations.
4.4.1	The cable shall satisfy the requirements of Rockbestos Cable Data Sheet Drawing # TD-5259 R03 issued Feb 28, 2005 and of this specification.
5.1.6 to 5.1.10	Sections 5.1.6 thru 5.1.10 will be replaced in its entirety with: 5.1.6 Environmental Qualification Test A qualification test shall be conducted to support the use of the Rockbestos Adverse Service Coaxial Cable for Class 1E applications as outlined in Rockbestos Test Plan 5802. The qualification plan shall be conducted: ▪ As detailed in Rockbestos Report # QR-6802, R02, titled: Report on Qualification Tests for Rockbestos Adverse Service Coaxial, Twin axial, and Triaxial Cable Generic Nuclear Incident for Class 1E Service in Nuclear Generation Stations, prepared by Rockbestos Company, dated December 7, 1990 ▪ In compliance with the recommendations from IEE Std. 323-1974, and from IEE Std. 383-1974 The test shall be conducted under Rockbestos QA Program which meets the requirements of the Quality Assurance Std. 10CFR50 App. B, including 10CFR Part 21 As a minimum but not limited to, the compliance with the Rockbestos Report #QR-6802, R02 shall include: ▪ Sample selection and description ▪ Test Sequences ▪ Test Methods ▪ Testing Configuration ▪ Acceptance Criteria ▪ Testing Instrumentation Additionally Rockbestos shall: ▪ Record all data resulting from the test sequences in data logs ▪ Use calibrated equipment. The calibration shall be traceable to the National Bureau of Standards ▪ Record, comment, and disposition all unanticipated variations and test anomalies ▪ Provide the minimum required margin for cable applicable environmental and operational parameters ▪ Provide clear conclusions regarding the cable performances in respected with the stipulated acceptance criteria It is expected that based on the qualification test, the Rockbestos coaxial cable will demonstrate the following EQ capabilities: ▪ Thermal Qualified Life >40 years@65°C, while continuously energized

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spares parts

OPG Specification: NK38-TSE-57100-10001, R000

SDS1 SDS2 and RRS Ion Chamber Coaxial Cable

Note: ***Exceptions and Clarifications as approved by Darlington Design Projects (see EC 81639) apply to Rockbestos RSS-6-111F/LE (CAT ID 617646-1) only***

Paragraph	Exceptions and Clarifications -
	▪ Demonstrated Total Integrated Dose of 200E6 rads Gamma equivalent ▪ Pass the DBA simulation as described in Rockbestos Report QR-6802, R02 (see above) Section 6 ▪ Withstand the dielectric test as described in the Rockbestos Report QR-6802, R02 (see above) Section 5 (including the post DBA dielectric strength test)
5.2.1	Production tests shall e conducted to prove the manufactured cable meets the requirements of this specification. The test results shall be approved and accepted by OPG Inspector before the cable is dispatched to the OPG site. The cable shall be tested in accordance with the requirements of Rockbestos Cable Data Sheet, Drawing # TD-5259 R03 issued Feb 28, 2005. Test shall be performed for each batch of cable.
6.1.1	Specific requirements for the RG-11A/U coaxial cable type shall be stated within the purchasing documents. Rockbestos Cable Data Sheet, Drawing # TD-5259 R03 issued Feb 28, 2005 would then be used to define the construction requirements.
6.1.6.1	The Thickness of the first (inner) jacket shall be 1.14 mm (0.045 inch) nominal and that the second (outer) jacket shall be 1.27 mm (0.050 inch) nominal.
6.2.1	Legible markings are required as specified in Rockbestos Cable Data Sheet, Drawing # TD-5259 R03 issued Feb 28, 2005 and in this specification. The printing colour shall contrast clearly with the background colour. The printing shall be well defined, legible and not indented. The printing ink and the cable components shall not have any deleterious effect on each other. There shall be no fading, cracking or blurring.
6.2.2	The cable jacket shall be printed throughout the length of the cable. Additional marking not specified in Rockbestos Cable Data Sheet, Drawing # TD-5259 R03 issued Feb 28, 2005 are listed below: ▪ The word “Nuclear-EQ” ▪ Ontario Power Generation Catalog Identification Number ▪ Cumulative sequential length markings at 1 meter intervals, starting at the inner end of the reel, on the opposite side of the above markings ▪ Year of manufacture ▪ The characters “FT1”
6.2.2.1	The letter shall be large enough to ensure that the printed markings are crisp and clear (legible) when viewed with normal or corrected-to-normal vision at a distance of not less than 1 meter.
7.3.1	Reel marking and construction shall be in accordance with Rockbestos Cable Data Sheet, Drawing # TD-5259 R03 issued Feb 28, 2005 and Ontario Hydro A-24M. In addition the OPG Catalog ID number shall be clearly marked as well as the length of cable supplied on the reel.
7.4	For shipment, the cable ends shall be durably sealed against the entrance of moisture with heat shrink end caps. In addition, during storage, and each time after some cable has been issued, OPG will install a reusable end cap on the cable end. For this purpose Rockbestos shall supply one reusable end cap with each reel of cable.

Further exceptions to type and production tests are as detailed in the following table.

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spare parts

2.0 Cables	**Type Test Requirements**				**Production Test Requirements**			
	FT4	**Acid Gas**	**Oxygen Index (OI)**	**Flexure Test**	**FTIR**	**Acid Gas**	**Oxygen Index (OI)**	**FT4**
300/600V/600V, Control, Armoured Control Cable Spec. #: N-TSE-57100-10000, R02 N-TSE-57100-10001, R01 N-TSE-57100-10023, R00	Separate test of 1 pair to qualify 1 and 2 pair, and 4 pair to qualify 4 and more pair construction. FT4 test on cable without filler will not qualify a cable constructed with filler.	Acid gas to be measured for each different sub-supplier lot of insulation formulation, jacket formulation and filler used to construct the FT4 type tested cable. If different sub-supplier lots are used to construct the type tested cable designs, separate acid gas tests are required for each sub-supplier lot. Do not require multiple tests of the same sub-supplier lot.	OI to be measured for each different sub-supplier lot of the insulation formulation, jacket formulation and filler used to construct the FT4 type tested cable. If different sub-supplier lots are used to construct the type tested cable designs, separate OI type tests are required for each sub-supplier lot. Do not require multiple tests of the same sub-supplier lot.	A sample of the completed cable shall be flexed whilst under tension, by either of the two methods shown in Section 1 of this EQPR.	Production FTIR measured for each different sub-supplier lot of insulation formulation. Do not require multiple FTIR tests of the sub-supplier lot of insulation formulation. If the same sub-supplier lot formulation used to construct any type tested or manufactured cable is used in this manufactured cable, the test would not be repeated.	Acid gas measured for each different sub-supplier lot of insulation formulation, jacket formulation and filler. If the same sub-supplier lot used to construct the type tested cable is used in the manufactured cable, the test would not be repeated.	OI measured for each different sub-supplier lot of insulation formulation, jacket formulation and filler. If the same sub-supplier lot used to construct the type tested cable is used in the manufactured cable, the test would not be repeated.	If any OI value measured during production tests is more than 1 unit below the value measured during certification (for the appropriate type test), the cable manufactured from the suspect compounds shall be tested and shall pass the FT4 flame test.
600V Power Cable, Spec. # N-TSE-57100-10002, R01	Same as above.	Same as above.	Same as above.	N/A	Same as above.	Same as above.	Same as above.	Same as above.
600V & 1000V Armoured Power Cable, Spec. # N-TSE-57100-10003, R00	Same as above.	Same as above.	Same as above.	N/A	Same as above.	Same as above.	Same as above.	Same as above.
Instrumentation Cable 300V, Spec. # N-TSE-57100-10004, R01	Same as above.	Same as above.	Same as above.	A sample of the completed cable shall be flexed whilst under tension, by either of the two methods shown in Section 1 of this EQPR.	Same as above, but also required FTIR test on each different sub-supplier lot of jacket formulation used over each individual pair/triad assembly.	Same as above.	Same as above.	Same as above.

Note: It is not the intent to require multiple FTIR, ACID GAS or OXYGEN index tests on the same sub-supplier lot of insulation or jacket formulation or the same sub-supplier lot of filler. Copies of test results obtained from a different cable, during type testing or production tests can be applied without re-testing to the same sub-supplier lot of insulation, jacket, or filler.

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spare parts

Cables	Type Test Requirements			Production Test Requirements			
	FT4	**Acid Gas**	**Oxygen Index (OI)**	**FTIR**	**Acid Gas**	**Oxygen Index (OI)**	**FT4**
Hook-up Wire 300V & 600V, Spec. # N-TSE-57100-10008, R01 N-TSE-57100-10025, R00	Not required (FT1 type test on insulated conductor only).	Acid gas to be measured for each different sub-supplier lot of insulation formulation used to construct the hook-up wire.	OI to be measured for each different sub-supplier lot of the insulation formulation used to construct the hook-up wire.	FTIR test is required for each different sub-supplier lot of insulation formulation used to construct the hook-up wire.	Acid gas to be measured for each different sub-supplier lot of insulation formulation used to construct the hook-up wire.	OI to be measured for each different sub-supplier lot of the insulation formulation used to construct the hook-up wire.	Not required (FT1 production test on insulated conductor only).
Coaxial Cable (Double Shielded Coaxial or Triaxial) Spec. # N-TSE-57100-10010, R00	Single test of smallest diameter cable will qualify larger cables of similar construction.	Acid gas to be measured for each different sub-supplier lots of insulation formulation and jacket formulations used to construct the FT4 type tested cable. Do not require multiple tests of the same sub-supplier lot of formulation.	OI to be measured for each different sub-supplier lot of insulation formulation and jacket formulations used to construct the FT4 type tested cable. Do not require multiple tests of the same sub-supplier lot of formulation.	FTIR production tests are required on each different sub-supplier lot of insulation and jacket materials, except the overlying Hypalon jacket. Tests to be performed on sub-supplier lot samples from cable that passed the FT4 flame test. Do not require multiple FTIR tests of the same sub-supplier lot of insulation and jacket formulations.	Acid gas measured for each different sub-supplier lot of insulation and jacket formulation. If the same sub-supplier lot of formulation used to construct the type tested cable is used to construct the production cable, the test would not need to be repeated.	OI measured for each different sub-supplier lot of insulation and jacket formulation. If the same sub-supplier lot of formulation used to construct the type tested cable is used to construct the production cable, the test would not need to be.	If any OI measured during production is more than 1 unit below the value measured for the appropriate type test, the cable manufactured from the suspect compounds shall be tested and pass the FT4 flame test.
RSS-6-111F/LE Coaxial Cable	As per the corresponding section in the technical specification: NK38-TSE-57100-10001, R00						
FF08500-000, Fiber Optic Cable	As per the corresponding section of OPG technical specification: NK38-TS-68000-10018, R001						

Note: It is not the intent to require multiple FTIR, ACID GAS or OXYGEN index tests on the same sub-supplier lot of insulation or jacket formulation or the same sub-supplier lot of filler. Copies of test results obtained from a different cable, during type testing or production tests can be applied without re-testing to the same sub-supplier lot of insulation, jacket, or filler.

3.0 STANDARD EQ MATERIALS

The items listed below have been assessed and environmentally qualified by OPG. The requirements outlined herein apply whenever the Catalog IDs listed below are purchased by OPG

Catalog ID	Cable Description	No. of Conductors	Conductor size	OPG Specification
552067-1	300V, Control Cable	1 pair	16 AWG, solid twisted	N-TSE-57100-10000
501350-1	300V, Control Cable	2 pair	16 AWG, solid	N-TSE-57100-10000
552069-1	300V, Control Cable	4 pair	16 AWG, solid	N-TSE-57100-10000
552070-1	300V, Control Cable	7 pair	16 AWG, solid	N-TSE-57100-10000
552071-1	300V, Control Cable	10 pair	16 AWG, solid	N-TSE-57100-10000
552853-1	300V, Control Cable	20 pair	16 AWG, solid	N-TSE-57100-10000
501392-1	300V, Control Cable	25 pair	16 AWG, solid	N-TSE-57100-10000
552072-1	300V, Control Cable	50 pair	16 AWG, solid	N-TSE-57100-10000
514178-1	300V, Control Cable	50	16 AWG, solid	N-TSE-57100-10000
538407-1	600V, Control Cable	2	14 AWG, stranded, non-shielded	N-TSE-57100-10001
275190-1	600V, Control Cable	2	16 AWG, stranded, shielded	N-TSE-57100-10001
552065-1	600V, Control Cable	3	18 AWG, stranded, with drain wire	N-TSE-57100-10001
540712-1	600V, Control Cable	3	18 AWG, 16S/0.25mm	N-TSE-57100-10001
548481-1	600V, Control Cable	4	2 AWG, stranded, shielded	N-TSE-57100-10001
473380-1	600V, Control Cable	4	14 AWG, stranded, non-shielded	N-TSE-57100-10001
628394-1	600V, Control Cable, Continuously Interlocked, Aluminium Armour, Jacket KH130	8	14 AWG, stranded XLPE KXL-760G	N-TSE-57100-10001
528667-1	600V, Control Cable, Gardex Continuously Welded, Aluminium Armour, Jacket KH130	8	14 AWG, stranded XLPE KXL-760G	
500754-1	600V, Power Cable	1	2/0 AWG, stranded	N-TSE-57100-10002
500752-1	600V, Power Cable	1	4 AWG, stranded	N-TSE-57100-10002
519814-1	600V, Power Cable	1	4/0 AWG stranded	N-TSE-57100-10002
519255-1	600V, Power Cable, Green	1	12 AWG, stranded	N-TSE-57100-10002
519372-1	600V, Power Cable, Black	1	12 AWG, stranded	N-TSE-57100-10002
519254-1	600V, Power Cable, XLPE (KXL-760G) Green	1	16 AWG, stranded	N-TSE-57100-10002
519386-1	600V, Power Cable, Grey	1	16 AWG, stranded	N-TSE-57100-10002
490847-1	600V, Power Cable, XLPE Insulation, Hypalon Jacket	1	500 MCM, stranded	N-TSE-57100-10002
550099-1	1000V, Power Cable, Non Shielded, Unarmoured	3	2 AWG, stranded, non-shielded	N-TSE-57100-10002
500578-1	600 V, Power Cable, unarmoured	3	4 AWG, stranded	N-TSE-57100-10002

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R018**
Applicable to:	Safety Related and EQ Items and spare parts

Catalog ID	Cable Description	No. of Conductors	Conductor size	OPG Specification
500576-1	600 V, Power Cable	3	6 AWG, stranded	N-TSE-57100-10002
490840-1	600V, Power Cable	3	8 AWG, stranded	N-TSE-57100-10002
490836-1	600V, Power Cable	3	10 AWG, stranded	N-TSE-57100-10002
500572-1	600V, Power Cable	3	12 AWG, stranded	N-TSE-57100-10002
521793-1	600V, Power Cable	3	250 MCM	N-TSE-57100-10002
490846-1	600V, Power Cable	3	350 MCM, stranded	N-TSE-57100-10002
541112-1	1000V, Power Cable	4	2 AWG, stranded, non-shielded	N-TSE-57100-10002
559386-1	1000V, Control Cable, Unarmoured	4	2/0 AWG, stranded, non-shielded	N-TSE-57100-10002
500563-1	600V, Power Cable	4	2 AWG, stranded	N-TSE-57100-10002
476570-1	600V, Power Cable	4	2/0 AWG, stranded	N-TSE-57100-10002
476569-1	600V, Power Cable	4	4 AWG, stranded	N-TSE-57100-10002
509725-1	600V, Power Cable	4	4/0 AWG, stranded	N-TSE-57100-10002
509729-1	600V, Power Cable	4	10 AWG, stranded	N-TSE-57100-10002
476563-1	600V, Power Cable	4	12 AWG, solid	N-TSE-57100-10002
510481-1	600V, Power Cable	2	8 AWG, stranded	N-TSE-57100-10002
509727-1	600V, Power Cable, Armoured	1	500 MCM, stranded	N-TSE-57100-10003
483636-1	600V, Power Cable, Armoured	2	8 AWG, stranded	N-TSE-57100-10003
542963-1	600V, Power Cable, Armoured	2	14 AWG, stranded	N-TSE-57100-10003
660639-1	600V, Power Cable, Armoured	2	12 AWG, stranded	N-TSE-57100-10003
547861-1	600V, Power Cable, Gardex, Continuously Interlocked Aluminum Armour c/w Bonding Conductor, KX	3	12 AWG, stranded	N-TSE-57100-10003
628393-1	600V, Power Cable, Gardex, Continuously Interlocked Aluminum Armour, c/w #14 AWG Ground Wire	3	12 AWG, stranded	N-TSE-57100-10003
	600V 3 Conductor Stranded Copper, #12AWG, EQ, Continuous	3		
510777-1	600V, Power Cable, KXL-760G XLPE, Inner/Outer Jackets And Alum Armour	4	8 AWG, stranded	N-TSE-57100-10003
628381-1 superseded 558990-1	600V, Power Cable, Continuously Interlocked Aluminum Armour	4	10 AWG, stranded	N-TSE-57100-10003
662877-1	600V, Power Cable, Armoured	5	14 AWG, stranded	N-TSE-57100-10003
988037-1	600V 3/C, 10 AWG 7/S, XLPE KXL-760G insulation, Galvanized Steel Interlock Armor; as per Dwg: TD-009639 (corresponding NK38-DRAW-57100-10046)	3	3/C, 10 AWG 7/S Tin Coated Copper conductor	N-TSE-57100-10003

Catalog ID	Cable Description	No. of Conductors	Conductor size	OPG Specification
483633-1	600V, Power Cable, Armoured	4	12 AWG, stranded	N-TSE-57100-10003
486654-1	600V, Hook-up Wire, Gray	1	16 AWG, stranded	N-TSE-57100-10008
560396-1	Triaxial (Double Shielded Coaxial) Cable	1	18 AWG, stranded	N-TSE-57100-10010
628395-1 superseded 533378-1	600V, Control Cable Continuously Interlocked Aluminum Armour	1 pair	16 AWG, stranded twisted, with drain wire	N-TSE-57100-10023
500761-1	300V, Control Wire, Black	1	16 AWG, solid	N-TSE-57100-10025
500767-1	300V, Control Wire, White	1	16 AWG, solid	N-TSE-57100-10025
500772-1	300V, Control Wire, Green	1	16 AWG, solid	N-TSE-57100-10025
534127-1	300V, Control Wire, Copper, Red	1	20 AWG, solid	N-TSE-57100-10025
534128-1	300V, Control Wire, Copper, Orange	1	20 AWG, solid	N-TSE-57100-10025
534129-1	300V, Control Wire, Copper, Blue	1	20 AWG, solid	N-TSE-57100-10025
534130-1	300V, Control Wire, Copper, Green	1	20 AWG, solid	N-TSE-57100-10025
617646-1	RSS-6-111F/LE Cable, Coaxial, 18 AWG Tinned Copper Conductor, 34 AWG Tinned Copper Braid Shield, w/ XLPO Insulation, FRXLPO 1st Jacket, and CSPE KH-131 2nd Jacket, Nuclear Class 1E.	1	18 AWG Tinned Copper Conductor, 34 AWG Tinned Copper Braid Shield	NK38-TSE-57100-10001, R00
643729-1	P/N: FS01016-035 Wire, Electrical, Hook-up, 1C, #16AWG, 7 Stranded, Tinned Copper, XLPE, KXL-760G, 90°C, 600V, Brown, Firewall SIS, Nuclear Class 1E, EQ	1	16AWG, 7 Stranded, Copper, XLPE, KXL-760G	N-TSE-57100-10008
676713-1	P/N: FS01014-66 Wire, Electrical, Hook-up, 1C, #14AWG, 7 Stranded, Tinned Copper, XLPE, KXL-760G, 90°C, 600V, Brown, Firewall SIS, Nuclear Class 1E, EQ	1	14AWG, 7 Stranded, Copper, XLPE, KXL-760G	N-TSE-57100-10008
551151-1	C524095; DWG. TD-004408 Cable, Electrical, Control 600V, 7C, 12 AWG Stranded Copper, XLPE Insulation, Non Shielded		12AWG, 7 Stranded, Copper, XLPE, KXL-760G	N-TSE-57100-10001
551152-1	C524094; DWG. TD-004409 Cable, Electrical, Control 600V, 9C, 12 AWG Stranded Copper, XLPE Insulation, Non Shielded		12AWG, 7 Stranded, Copper, XLPE, KXL-760G	N-TSE-57100-10001

Catalog ID	Cable Description	No. of Conductors	Conductor size	OPG Specification
1002185-1	FF08500-000, Dwg: RS-DNS-5409 Cable, Fiber Optic, EQ, 8 radiation resistant 50/125µm multimode fibers, 2 concentric layers of acrylate coating, SS tube (Type 316 SS), helically stranded wire armor (SWA) (13 type 316 SS armor wires).			NK38-TS-68000-10018, R001

4.0 CHANGES IN DESIGN AND SUBSTITUTION OF EQ MATERIALS

As a condition of this contract Rockbestos shall notify OPG Buyer using form N-FORM-10393 subsequent to contract award and N-FORM-10115 during bidding if there is any change in design, materials used in manufacture, compound(s) used for non metallic components, manufacturing methods, or non-destructive testing procedures in the manufacturer of the cable or its subcomponents.

Rockbestos shall ensure contractual provisions and QA program requirements imposed on suppliers and sub suppliers is such that Rockbestos will be notified of any such changes that may occur within the supply chain.

Alternatively, Rockbestos shall notify the OPG Buyer using the same forms if, for any reason, it is not able to provide assurance that there have been no such changes since the cable was originally tested/assessed and qualified for use in a nuclear safety-related application.

OPG Buyer will forward all such notifications to OPG Design Authority. All decisions relating to the need to retest and re-evaluate the cable shall be made by OPG responsible Design Authority. Although the Design Authority may solicit the Rockbestos input to the decision, the decision of the OPG Design Authority will be final.

Rockbestos is advised that:

This item will be installed in a nuclear safety system. That system will be required to operate following a very unlikely but theoretically possible design basis accident. If such an accident occurred the item could be subjected to a harsh environment consisting of chemical and pressure transients, radiation, steam, elevated temperature and pressure, or submergence. It is possible that the design basis accident could occur at a time when the item has already been subjected to many years of normal operation when it is nearing the end of its useful operating life. This item has been rigorously evaluated /tested, and the OPG Engineer expects that it will perform its intended safety function following exposure to this harsh environment.

OPG's Environmental Qualification Assessment (EQA) has established that the item will perform its intended safety function. This EQA will not be valid if there is a substitution of materials, changes in design, or changes in manufacturing methods. This is especially true for changes or substitutions of non-metallic components used in the construction of this item. Some non metallic components are known to be subject to degradation in a harsh environment and can deteriorate quickly when exposed to steam, heat, or especially when exposed to high levels of radiation.

OPG Engineer accepts that changes in design, sub suppliers, materials, and manufacturing methods may be necessary as technology and manufacturing processes change with time. The OPG Engineer also accepts that companies may not be able to track all changes that occur over a long period of time. It is the OPG Engineer's objective to minimise unnecessary changes that would necessitate a re-evaluation of the item's ability to perform its intended safety function following a Design Basis Accident as even minor changes may dictate the need to retest or re-qualify the item. In any event, it will certainly dictate the need to evaluate the effect of the change, and a revision to the EQA to ensure that the new item will perform the same intended safety function as the item that was previously qualified.

5.0 QUALITY ASSURANCE PROGRAM FOR ENVIRONMENTALLY QUALIFIED ITEMS

Rockbestos shall implement and maintain a quality assurance program that provides assurance that the design, materials used in construction, and methods used in fabrication/construction and non-destructive testing of the cable are such that the cable both meets the design requirements and is equivalent to the cable evaluated and tested.

In order to provide this assurance Rockbestos QA program shall meet the requirements Z299.2-1985 quality program, including the requirement for product traceability.

Rockbestos QA Manual (audited by NUPIC to the requirements of 10CFR50, App B quality program) reviewed/accepted by OPG to the requirements of CSA Z299.2 along with the requirements specified in the OPG P.O. is acceptable to OPG to meet this requirement.

Note: *The requirements of 10CFR Part 21 (Reporting of Defects and Noncompliance) shall survive the completion of the contract as if the item was supplied to a USA based nuclear utility.*

All items shall be traceable to Rockbestos manufacturing facility in **East Granby, CT, USA.**

Rockbestos shall ensure that activities undertaken by its authorized distributor/sales agent do not jeopardize traceability.

For all orders placed with an authorized distributor/sales agent this facility shall provide evidence that the order has been reviewed and accepted by the facility indicated above (East Granby, CT). That evidence can be in the form of the Certificate of Conformance in Section 9.0 below.

6.0 INSPECTION AND TEST PLAN AND CRITICAL PROCESS PROCEDURE ACCEPTANCE

In accordance with CSA Z299.2/3 QA standards, Rockbestos shall prepare the Inspection and Test Plan (I&TP) document as part of the QA program requirements. A copy of the completed I&TP, signed by the authorized QA representative as a minimum, shall be submitted to OPG with the shipment.

However, OPG review and acceptance of the I&TP prior to initiating the work is required only when the “Inspection and Test Plan Submission Requirement” clause “QA-I&TP” is specified elsewhere in the OPG Contract P.O. This includes the situation for initial procurement of new items not previously manufactured and supplied to OPG.

The OPG Engineer reserves the right to identify a list of special process and non-destructive examination procedures that shall be submitted for OPG review and acceptance prior to completing the work described on these procedures. The list will be identified at the time OPG Engineer reviews the Inspection and Test Plan.
The plan and associated procedures are to be submitted for OPG review/acceptance at least 4 weeks prior to commencement of the work outlined on the plan or procedure.

In the event that delay in receiving approval will delay completion of the work, Rockbestos is to notify OPG Buyer, at least 1 week in advance of the occurrence of the delay, so the OPG Buyer can expedite OPG Engineer review and acceptance and mitigate the delay.

OPG reserves the right to review these documents during QA program audits or contract specific inspections in order to verify that manufacturing and inspection activities are appropriately planned, authorized and controlled. Rockbestos critical process procedures and ITP shall be available for audit by OPG source inspectors.

Note: *Personnel performing inspection, witnessing or monitoring of item critical characteristics for their acceptance must not be those who have performed the work being inspected or report directly to immediate supervisors responsible for producing the work unless specifically permitted otherwise in the I&T Plan and agreed to in writing by the customer before the contract is let.*

7.0 MARKING AND TAGGING OF THE CABLE

Marking and tagging of cables shall be in accordance with the technical Specifications listed in Section 1.0 of this EQPR. In addition, the following information shall be marked on the cable:

- The cumulative sequential length markings shall be followed by the letter “M”.
- The Catalogue ID marking shall be preceded by the characters “CATID:”
- The CSA logo/ markings, where available.
  Note: CSA marking will only be applied on cables that meet CSA Standard.
- The manufacturer’s name or trade mark shall be marked on the cable jacket.
- The manufacturer’s traceability number, which can be used to trace all components back to the individual vendors, shall be printed on the cable.
- The characters “NUCLEAR - EQ” shall be printed on the cable in lieu of the characters “NUCLEAR” called for in the Specifications.

All markings and tagging shall be clear, unambiguous, and indelible.

It is understood that Rockbestos has voluntarily obtained certification per the Electrical Safety Code for most cable configurations. Where CSA approval has been obtained appropriate markings is to be applied on the cable.

8.0 MARKING AND TAGGING OF THE REEL

Marking and tagging of the reel shall be in accordance with the technical Specifications listed in Section 1.0 of this EQPR. In addition, the following markings shall also appear on the reel:

- “Store in Class C (B - for the 300V and 600V Hook-up Wire) storage or better, and warm to a minimum temperature of 10°C before flexing”.
- The unique reel number.
- Procedures for resealing shall be marked on a tag attached to the reel.
- The shelf life expiry date.
- OPG Catalogue ID number as shown in the purchase order, preceded by the characters “CATID:”
- The minimum bending radii (mm) for pulling and training.

All markings and tagging shall be clear, unambiguous, and indelible.

9.0 PROTECTION FROM DEGRADATION DURING SHIPMENT OR STORAGE

Cables shall be protected, handled and stored as per requirements of OPG Technical Specifications listed in Section 1.0 of this EQPR (with exceptions and clarification as listed). The cable ends shall be durably sealed against the entrance of moisture, and secured in a manner that will ensure the integrity of the cable and sealing system is maintained.

The Storage level “B” is required for the 300V and 600V Hook-up wires.

10.0 CERTIFICATION TO ACCOMPANY SHIPMENT

In addition to the documentation listed in the technical specifications listed in Section 1.0 of this EQPR, Rockbestos shall supply a certificate to accompany the shipment of the cable. This certificate shall be signed by the Rockbestos’ QA authority and shall certify that:

- The cable has been manufactured under Rockbestos QA program (audited by NUPIC to the requirements of 10CFR50, Appendix B) accepted by OPG, and the requirements of the OPG P.O.
- The cable supplied is equivalent to the cable originally manufactured by Rockbestos, which is described in the qualification test report numbers listed in Section 1 of this EQPR (Rockbestos to insert the applicable number from Section 1).

Note:

If there is a change or substitution of material, design, compounds used in construction, manufacturing method(s) or nondestructive method is proposed or identified, that change shall be reviewed/accepted by the OPG Engineer

in writing prior to shipment. Evidence of that acceptance shall accompany the certification statement and the wording of the statement shall be suitably modified to reflect the change and the acceptance.

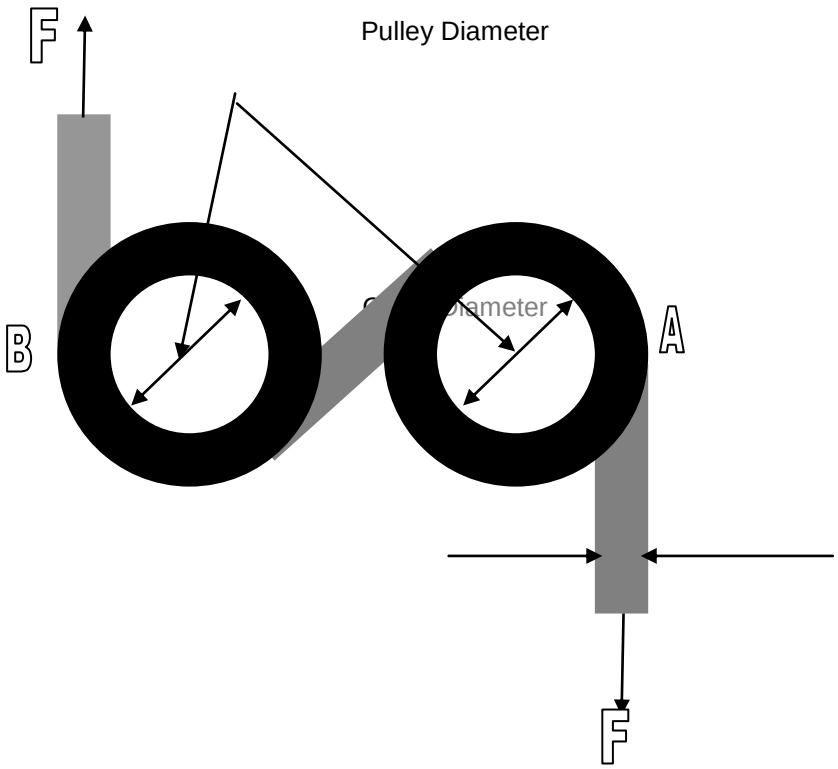
The certificate shall also clearly indicate the following:

- *The manufacturers name.*
- *The traceability number for the cable supplied.*
- *The reel numbers for the cable supplied.*
- *OPG purchase order number and Catalog ID number.*

The name and title of QA authority shall appear below the signature and the approval date shall be clearly evident.

Rockbestos shall also supply a Material Safety Data Sheet (MSDS) for any loose hazardous materials. The Hazardous Material Information Review Act provides some protection of trade secret or proprietary information. Rockbestos shall demonstrate compliance to the Ontario Occupational Health and Safety Act (OHSA), with respect to disclosure of MSDS information. MSDS data sheets shall be supplied in accordance with the Laws of the Province of Ontario. In lieu of submitting an MSDS, OPG will accept certification that the cable components contain no loose hazardous materials that require submission of an MSDS. If a lubricant of any kind is applied to the insulation and or jacket, an MSDS for this material shall be supplied.

11.0 CABLE FLEXURE TEST (TYPE TEST) – FOR SHIELDED CABLES ONLY

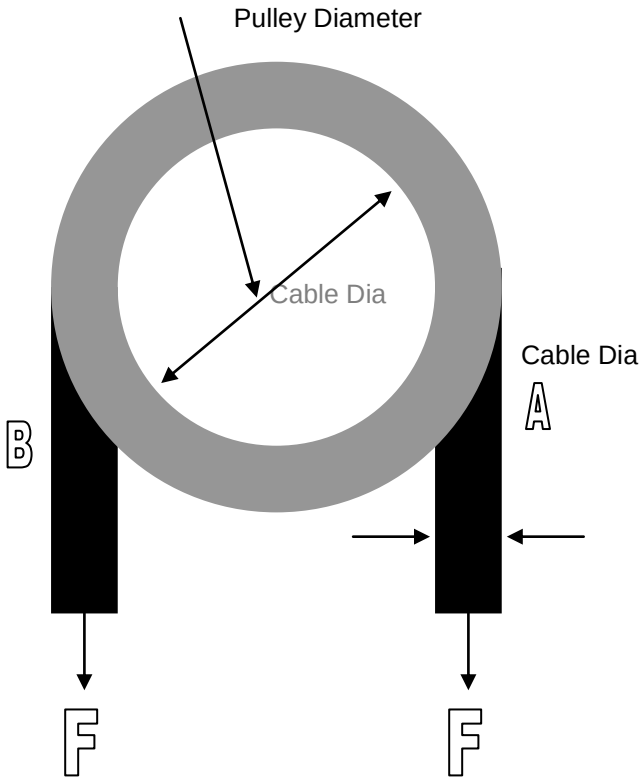


Notes: (1) The value of the tensile force F should be obtained from the appropriate Clause of this EQPR.
(2) One cycle is completed when point “A” moves to point “B” or point “B” moves to point “A”.
(3) The ratio of cable diameter to pulley diameter shall not be more than 1:14.

CABLE FLEXING TEST UNDER A CONSTANT LOAD, METHOD “A”

Procurement Engineering Standard Purchase Clause

Code:	**EQ ROCK B**
Title:	**EQPR FOR ROCKBESTOS CABLES** **R017**
Applicable to:	Safety Related and EQ Items and spare parts



Notes:
(1) The value of the tensile force F should be obtained from the appropriate Clause of this EQPR.
(2) The following constitutes one flexing cycle:
  (a) Pull “A” to point “B”, clear of pulley.
  (b) Remove tensile force and turn cable through 180° so that part of cable previously on outer bend (in tension) is now in contact with the pulley (and will be in compression).
  (c) Reapply the force and pull point “B” to point “A”.
(3) The ratio of cable diameter to pulley diameter shall not be more than 1:14.

CABLE FLEXING TEST UNDER A CONSTANT LOAD, METHOD “B”