A Division of RSCC Cable Group
ISO 9001 Registered

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July 20, 2012

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Final Report on RSCC Wire & Cable LLC's Firezone 3HR 600V Cables

Reference: Initial Notification of 10CFR Part 21 Defect/
Failure to Comply dated May 30, 2012

Dear Sir or Madam:

RSCC Wire & Cable LLC has prepared and approved TR-1210 Rev 0, dated 7/19/12, entitled "Firezone 3HR Installation Guidelines" in response to the referenced Initial Notification dated May 30, 2012 and RSCC's Corrective Action Request 12-19. Copies of TR-1210 Rev 0 have been forwarded to Comanche Peak Nuclear Power Plant and the Dresden Nuclear Power Plant for their determination of whether any installed Firezone 3HR cables could cause a substantial safety hazard.

Sincerely,

Richard Brown
Quality Assurance Manager

IE19
NRR

RSCC WIRE & CABLE LLC

# Firezone 3HR

## Installation Guidelines

TR-1210 Rev 0

**7/19/2012**


Prepared By: Robert L. Konnik

Chief Technology Officer

Approved By: Robert A. Gehm

Applications Engineering Manager



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# Introduction

This report covers basic installation recommendations for RSCC Firezone® 3HR cable. The focus is on special instructions for this fire rated cable. All standard installation precautions for a tray cable should be followed. It is assumed that the cable has been properly sized and the installation properly designed. Since not all situations can be covered, please call the RSCC Engineering Department for more specific information. The National Electrical Code as well as all applicable rules and regulations, including federal, state, local, and municipal laws should be followed.

# Tested Configuration

Firezone® 3HR is qualified for 3 hour circuit integrity to UL 2196. The smallest conductor size qualified is 12 AWG with a minimum of 2 conductors. The cable must be installed in accordance with this installation guide which takes into account the manner that it was tested and qualified.

# Cable Installation

Cable installed outside the fire zone follows the same guidelines as any other tray cable and should be installed per the National Electrical Code. This includes installing Firezone® 3HR cable in tray or conduit with halogenated cable.

In the fire zone, precautions must be taken to ensure other aspects of the system do not limit the survivability of the cable. This includes conduit and tray support mechanism are fire rated for the installation and that cable splices are not permitted unless cable splicing is conducted within an equivalent fire rated room.

Cable installed in conduit within the fire zone should comply with the following:

1) Firezone® 3HR cable must be installed in a dedicated stainless steel rigid metal conduit of minimum conduit sizing of 1 ½ inches in diameter with no other halogenated products i.e. cables and the conduit support spacing should not exceed 72 inches on center.
2) Firezone® 3HR cable should not be installed in galvanized rigid metal conduit unless the galvanized rigid metal conduit is protected by an approved thermal barrier for the specific fire rating within the fire zone. The galvanized steel conduit would likely limit the cable survivability to less than 3 hours.

3) Firezone® 3HR cable must not be installed in conduits that contain halogenated products i.e. cables unless the conduit is protected by an approved thermal barrier for the specific fire rating within the fire zone.
4) The maximum conduit fill ratio for Firezone® 3HR cable is 30%.

Cable installed in tray within the fire zone should comply with the following:

1) Firezone® 3HR cable must be installed within a flexible or rigid stainless steel metal conduit on stainless steel or galvanized steel tray of the following types: (solid bottom, open ladder or vented trough). Tray support spacing should not exceed 48 inches on center. Conduit fill ratio must not exceed 30%.
2) Firezone® 3HR cable should not be installed in aluminum cable trays as the tray will melt in a fire and may limit the cable survivability.
3) Firezone® 3HR cable must not be installed in cable trays that contain halogenated products i.e. cables unless the Firezone® 3HR cable is installed within a flexible or rigid stainless steel metal conduit which provides isolation/separation from the halogenated cables and the flexible or rigid stainless steel metal conduit must not exceed 30% fill ratio.
4) Firezone® 3HR cable cannot be installed in tray of any type unless the cable is installed within a flexible or rigid stainless steel metal conduit and conduit fill ratio must not exceed 30%.

Penetrations within the fire zone should comply with the following:

1) Firezone® 3HR cable can run through concrete wall penetrations in rigid stainless steel conduits without halogenated products i.e. cables. Conduit fill ratio must not exceed 30%.
2) Firezone® 3HR cable can run through concrete wall penetrations in rigid metal conduits with halogenated products i.e. cables provided the Firezone® 3HR cable is installed within flexible or rigid stainless steel conduit without halogenated products i.e. cables through the wall penetration. Conduit fill ratio must not exceed 30%.

# Additional Installation Information

## Pulling Lubricants

The following pulling lubricants may be used with Firezone® 3HR cable:

Polywater LZ, CLR and Dyna Blue may be used with cables listed in this system.

## Bending Radius

Minimum permanent training radius is 4 times the outside diameter of the cable for cables up to 1 inch in diameter, 5 times the cable outside diameter for cables from 1.001 inch to 2 inch and 6 times the cable outside diameter for cables larger than 2 inch in diameter. Recommended pulling radius is 2 times the permanent training radius.

## Conductor Tensile Strength

It is assumed that the method used to attach the cable to the pull rope transfers all forces to the conductor. The tensile strength of the conductor then becomes a limiting factor for the force that can be applied. Copper elongates slightly before breaking, which changes the resistance characteristics. A safety factor is used to prevent this, as well as other items. This tension is determined by the following formula:

$$Tc = K \times F \times kcmil_T$$

Tc = Maximum allowable tension based on conductor tensile strength (pounds)

K = Factor based on material strength with a safety margin;
8 for annealed copper

F = Factor to account for possible unequal tension distribution

$kcmil_T$ = The sum of the circular mil area of all conductors in thousand circular mils (kcmil)

When all conductors are the same size, the equation becomes:

$$Tc = K \times F \times kcmil \times N$$

| | | |
|---|---|---|
| kcmil | = | Circular mil area of one conductor in thousand circular mils (kcmil) |
| N | = | Total number of conductors pulled |

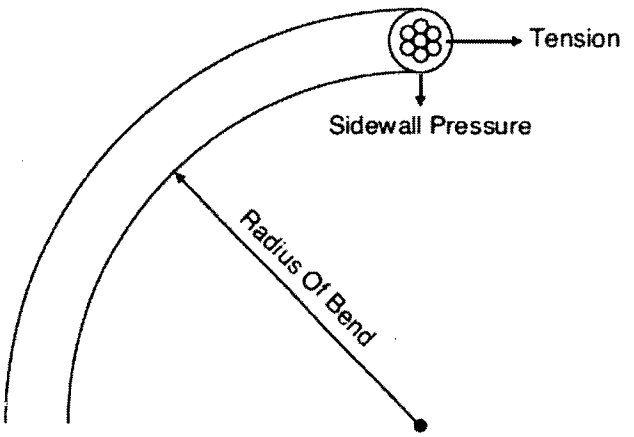
The tension distribution factor (F) is 1 for a single multiconductor cable, 0.8 when pulling more than one cable of equal conductor size, and 0.6 when pulling multiple cables of unequal conductor size. Ground wires should not be considered in these computations.

## Cable Attachment Limit

The maximum allowable tension is also limited by the ability of the device used to connect the cable to the pull rope to withstand the forces applied. When pulling by gripping the conductors with a pulling eye or bolt, the maximum tension is usually limited to 10,000 pounds. This is dependent upon the pulling eye or bolt used and the method of application. The manufacturer's recommendations should be followed. When the conductors are gripped with a properly sized and applied basket weave grip, the limit is 1000 pounds. This is based upon the hoop stress applied with a basket grip and the cable construction.

## Sidewall Pressure

When a cable is pulled around a bend, radial force is exerted on the insulation, and jacket as the cable is pressed against the inner arc of the bend (see Figure Below). This is referred to as sidewall pressure and is expressed as pounds per foot of radius.



Sidewall pressure is important in cable pulling calculations for two reasons. The first is its increase in the total pulling tension due to greater pressure between the cable and the bend. The second is its crushing effect upon the cable insulation and the possibility of permanent damage to the insulation and/or the cable jacket if excessive sidewall pressures are permitted. Sidewall pressure is usually the determining factor when establishing maximum allowable pulling tension for large conductor sizes.

The maximum value for sidewall pressure depends on the cable design. For Firezone® 3HR the sidewall pressure should not exceed 300 pounds per foot of bend. The formula for sidewall pressure for a single cable is as follows:

$$Tp = SWP \times R$$

Tp = Maximum allowable tension which will not exceed the sidewall pressure limit in pounds*

SWP = Sidewall pressure limit in pounds per foot

R = Radius of bend in feet

* This value may be more limiting than the maximum tension Tp based on conductor strength. The lower value of the two governs.

## Minimum Installation Temperature

Handling or pulling cables in extremely low temperatures can cause damage to the cable shielding, jacketing, or insulation. To prevent damage of this nature, cables should not be removed from reels or coils, handled, or pulled, without first warming in a heated area (at least 50°F/10°C) for at least 24 hours prior to installation. Cable should be installed as quickly as possible after warming. Minimum installation temperatures will vary depending upon the type of insulation and jacket material used on the cable. A value of -10°C (14°F) is typically recommended for all cables because this will allow for a considerable degree of rough handling.

**RSCC WIRE & CABLE LLC**
**CORRECTIVE ACTION REQUEST**

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|---|---|---|---|---|
| **CAR No.:** | 12-19 | | **Issue Date:** | 5/30/12 |
| | | | **Date Response Due:** | 6/29/12 |
| **Responsible Manager:** | | Robert Gehm | | |
| **Initiated By:** | | Richard Brown | **Supplier:** | N/A |
| **Authorized By:** | | Richard Brown | **Internal:** | Utility |
| **Source Document:** | | 10CFR21 | **Audit No.:** | N/A |
| **Reportable per 10 CFR 21 No Yes X** | **(if yes, see procedure 010SP004)** | | | |

**Description of Nonconforming Condition:**
Ref.: TXU PO# S 0697703 6S1 (RSCC SO# 93435)
Firezone 3HR 600V cables were installed at the Comanche Peak Nuclear Power Plant in a configuration inconsistent with the manner in which the cables were tested and qualified to UL 2196. As a result, under fire conditions, the Firezone 3HR cables may not function as tested and qualified. No documented installation procedures are currently available for Firezone 3HR cables.

**Root Cause:**
**Cable installation instructions, UL FHIT 31 Electrical Circuit Protective Systems, provided prior to delivery were insufficient to permit adequate installation in trays and conduit to ensure that the Firezone 3HR cable will function as tested and qualified under fire conditions during its installed qualified life.**

| **Response By:** | **Robert Gehm** | **Date:** | **6/18/12** |
|---|---|---|---|

**Immediate Action to be Taken:**
**Detailed installation guidelines for Firezone 3HR cables will be prepared and issued to purchasers that will ensure that cable qualification is maintained throughout its qualified life.**

| **Response By:** | **Robert Gehm** | **Date:** | **7/19/12** |
|---|---|---|---|

**Verification of Immediate Action Taken:**
**An installation guide, TR-12010 Rev 0, Dated 7/19/2012, Installation Guidelines for Firezone 3HR was written and approved. (R. Brown verified on 7/20/2012)**

**Corrective Action to be Taken to Prevent Recurrence:**
**The installation guideline report, TR-1210, will be provided prior to shipment of any Firezone 3HR product to customer. Copies of TR-1210 Rev 0 will be forwarded to Comanche Peak Nuclear Power Plant and Dresden Nuclear Power Plant.**

| **Response By:** | **Robert Gehm** | **Date:** | **7//20/12** |
|---|---|---|---|

**Verification of Effectiveness:**
**TR-1210 Rev 0 was forwarded to Comanche Peak Nuclear Power Plant and Dresden Nuclear Power Plant on 7/20/12.**

**RSCC WIRE & CABLE LLC**
**CORRECTIVE ACTION REQUEST**

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|---|---|---|---|
| **Closed By:** | **Richard Brown** | **Date:** | **7/20/12** |

**Distribution: R. Brown,** D. Chalk, R. Gehm, R. Konnik, M. Mennone, D. Murphy, S. Sandberg, M.Valaitis