eThekwini Electricity MV Switchgear flash over, and injury to staff member.

Presentation to AMEU Technical Meeting Sept 2009.
By Roy Wienand
A bad day at the office for Electricians:

ARC FASH
ARC FLASH

What Happens During An Electrical Arc?

- **Arc Blast**
  - 1,200 km/h
  - Shock Wave
  - 12,000°C
  - 1,000 °C
  - < 1,200 km/h

- **Arc Flash/Flashover**
  - 300,000 km/s
  - Radiation Wave
  - Visible Radiation
  - Ultraviolet Radiation
  - Infra Red Radiation
  - 165 db
  - < 1,000°C
  - 50 cal/cm²

Associated risks:
- Burn injury through arc radiation energy, molten metal splashes and flames
- Noise & pressure injury through shock wave
- Smoke inhalation injury
Shaun Huston. Switching Officer
Shaun after a few days in hospital
Shaun after a few days in hospital
Shaun after a few days in hospital
<table>
<thead>
<tr>
<th></th>
<th>ICU* Days</th>
<th>Hospital Cost</th>
<th>Rehab</th>
<th>Production Loss</th>
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</thead>
<tbody>
<tr>
<td>ICU</td>
<td>4</td>
<td>R20 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Ward</td>
<td>18</td>
<td>R25 000</td>
<td>R20 000</td>
<td>1</td>
</tr>
<tr>
<td>Home</td>
<td>21</td>
<td>R0</td>
<td>R3 600</td>
<td>1</td>
</tr>
<tr>
<td>Light Duty</td>
<td>30</td>
<td>R70 000</td>
<td>R28 600</td>
<td>1</td>
</tr>
</tbody>
</table>

Shaun Huston medical costs
Distributor S/S actual site
Distributor Sub Station wall.
Actual Faulted Switch
Actual Faulted Switch
Actual Faulted Switch
Actual Faulted Switch
Actual Faulted Switch
ARC FLASH HAZARD ANALYSIS

• Establish flash protection boundary

An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur.

• Determine required personal protective equipment (PPE) levels

• Select appropriate PPE
ARC FLASH

ARC FLASH HAZARD ANALYSIS

**NFPA 70E: 3-Ways to Analyze the Arc Flash Hazard**

A Flash Hazard Analysis will determine the flash protection boundary and the personal protective equipment that people within the flash protection boundary should use. There are three ways provided within NFPA 70E to perform a Flash Hazard Analysis to determine the required performance level of protective clothing for the corresponding Hazard Risk Category, which are highlighted below.

### 1 Detailed Flash Hazard Analysis

There are multiple tools available to the industry to help perform a Flash Hazard Analysis on energized equipment. Where it has been determined that a person will be working within the flash protection boundary, the Flash Hazard Analysis shall determine, and the employer shall document, the incident energy exposure of the worker (in calories per square centimeter). The determination of the incident energy can be performed using multiple tools:

- NFPA 70E Equations (Examples given in 70E; Annex D)
- ArcPro (KineticTechnics)
- IEEE 1584
- SKM Power Tools

After the incident energy has been determined, and documented, the proper fabric for the protective clothing can be selected.

### 2 NFPA 70E Hazard/Risk Category Classifications or Job Task Matrix

The second way is using the Hazard/Risk Category Classifications or Job Task Matrix provided in NFPA 70E. The Job Task Matrix identifies the Hazard Risk Category (HRC) for common electrical job tasks. For more information order a copy of NFPA 70E, which is available from the National Fire Protection Association (www.nfpa.org).

### 3 Annex H Simplified: Two Category, Flame Resistant (FR) Clothing Approach

The use of Table H.1 is suggested as a simplified approach to assure adequate PPE for electrical workers within facilities with large and diverse electrical systems. The clothing listed fulfills the minimum FR clothing requirements of the NFPA 70E Table 130.7 (C) (10) and 130.7 (C) (11).

**Table H.1 Simplified, Two-Category, Flame-Resistant Clothing System**

<table>
<thead>
<tr>
<th>Clothing*</th>
<th>Applicable Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyday Work Clothing</td>
<td>ATPV ≥ 8</td>
</tr>
<tr>
<td>Note:  INDERA® Ultra Soft® Style 301 7 oz. = 8.7</td>
<td></td>
</tr>
<tr>
<td>INDERA® Ultra Soft® Style 451 9 oz. = 12.4</td>
<td></td>
</tr>
<tr>
<td>Electrical “Switching” Clothing</td>
<td>ATPV ≥ 40</td>
</tr>
<tr>
<td>Note:  INDERA® Ultra Soft® two-layer options available &gt; 40</td>
<td></td>
</tr>
</tbody>
</table>

The information regarding NFPA 70E contained in this brochure is condensed for brevity. Users should consult the NFPA 70E document for complete information. NFPA 70E is available from the National Fire Protection Association (www.nfpa.org).
PPC – Protect specific areas of the body:

- Head, face, neck
- Eyes
- Body
- Hands & arms
- Feet & legs
Head, Face, Neck & Chin Protection

- Head gear Kit
- Flash Hood
- Balaclava
Eye Protection

Hazards:
- UV
- IR
- High energy light
- Debris

DO NOT USE A CLEAR VISOR

PPC AND EQUIPMENT

Face shield

Face shield

Goggle

Face shield
Body Protection

- Insulated jacket
- Switching suit
- Shirt
- Jeans

Important:
- Coverage
- Fit
- Layering
- Maintenance
- Labeling
Labeling of PPC

- Manufacturers name or trademark
- Year of manufacture
- Size designation
- ATPV rating
- Care labeling instructions
- Number of washes
Hand and Arm protection

Gloves
Foot Protection

- Good quality leather footwear - EN 345
- Electrical resistance to dry conditions

CSB Lite

GP 300
The Underwear Question:

- Not calculated towards ATPV protection levels
- Flame resistant
- Non melting
  
  Fabric:
  
  Cotton – in under layers when no break open risk
  Wool – in under layers when no break open risk
  Silk – in under layers when no break open risk

- Arc resistance undergarments
**Product Category:** Survive-ARC

**Sub Category:** Switching Garments

<table>
<thead>
<tr>
<th>Product</th>
<th>Colour</th>
<th>Sizes</th>
<th>Material</th>
<th>Manufactured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survive-ARC® Arc Flash Protective Suit HRC 4, ATPV 100.8 cal/cm²</td>
<td>Visual orange</td>
<td>S – 5XL</td>
<td>Imported</td>
<td>South Africa</td>
</tr>
</tbody>
</table>

**Description:**

**Two piece arc flash switching suit – ATPV 100.8 cal/cm².** Long jacket, bib and brace trousers, layered fabric composition. ATPV rating indicated on both garments.

**Jacket:** 88cm long jacket (Large) with Nomex zip, FR Velcro front closure and UltraSoft ® knitted cuffs.

**Trousers:** Bib & Brace trousers.

**Hood:** See separate Product Data Sheet

**Material:**

**Fabric:** Guaranteed flame resistant for the life of the garment

Outer: Indura® UltraSoft® Flame Resistant pre-shrunk cotton blend, 440 g/m²

Liner: 3 layers Indura® UltraSoft® Flame Resistant pre-shrunk cotton blend

**Thread:** Meta Aramid high temperature thread

**Standard:**

**Fabric:**


ATPV¹ : 100.8cal/m²

HAF² : 98%
## PPC AND EQUIPMENT

<table>
<thead>
<tr>
<th>Product Category:</th>
<th>Survive-ARC</th>
<th>Sub Category:</th>
<th>Switching Garments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product:</strong></td>
<td>Survive-ARC® Arc Flash Protective Hood</td>
<td><strong>Colour:</strong></td>
<td>Visual Orange</td>
</tr>
<tr>
<td></td>
<td>HRC 4, ATPV 100.8 cal/cm²</td>
<td><strong>Sizes:</strong></td>
<td>One size fits all</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Material:</strong></td>
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<tr>
<td></td>
<td></td>
<td><strong>Manufactured:</strong></td>
<td>South Africa</td>
</tr>
</tbody>
</table>

### Description:
**One piece arc flash switching hood – ATPV 100.8 cal/cm²**
One piece, shaped hood, consisting of layered fabrics, large viewing protective lens attached to internal brow guard and suspension system. ATPV rating indicated on hood.

### Material:
- **Fabric:** Guaranteed flame resistant for the life of the garment
- **Outer:** Indura® UltraSoft® Flame Resistant pre-shrunk cotton blend, 440 g/m²
- **Liner:** 3 layers Indura® UltraSoft® Flame Resistant pre-shrunk cotton blend
- **Thread:** Nomex high temperature thread

### Standard:
- **Fabric:**
  - ATPV¹ : 100.8cal/m²
  - HAF² : 98%

### Lens:
- **Dual pane, anti-fog, amber colour.**
- **ANSI Z87:1; EN 168**
PRODUCTS
Accessories

<table>
<thead>
<tr>
<th>Product Category:</th>
<th>Survive-ARC®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub Category:</td>
<td>Accessories - Head</td>
</tr>
</tbody>
</table>

**Product:** Survive-ARC® Goggle HE

**Colour:** Black frame with black bezel

**Sizes:** Universal adjustable

**Material:** Imported

**Manufactured:** Imported

**Description:**

**ARC Goggle High Energy, HRC 4, ATPV 45 cal/cm²**
A primary protective goggle designed to specifically address the requirements of arc flash protection. Product weight 204 gm.

**Important:** Must be worn with an approved arc flash balaclava that meets or exceeds the hazard assessment requirement for electric arc flash safety. Use an appropriate helmet/hard hat to provide required impact protection.

**Material:**

- **Lens:** Optically correct dual layer lens. Outer polycarbonate lens is hard coated and the inner propionate lens is anti-fog coated. Nanotechnology design provides the highest level of arc protection and durability for the VLT.
- **Strap:** Silicone, easily adjustable with gloves.
- **Frame:** Silicone, fits over most prescription safety spectacles.

**Colours:**

- Black with Blue Bezel

**Standards:**

- NFPA 70E-2004
- ANSI Z87.1
- ASTM F2178
Thank You. Any Questions?

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