Learning & Sharing with RMEs on ELECTRICAL WIRING SAFETY

PDP SAFETY SHARE

L & S Presentation Outline

Personal Protective Equipment (PPE)

- Basic Concepts of Electricity
- Hazard Recognition
- Effects of Electricity on the Human Body
- Electrical Hazard Protection

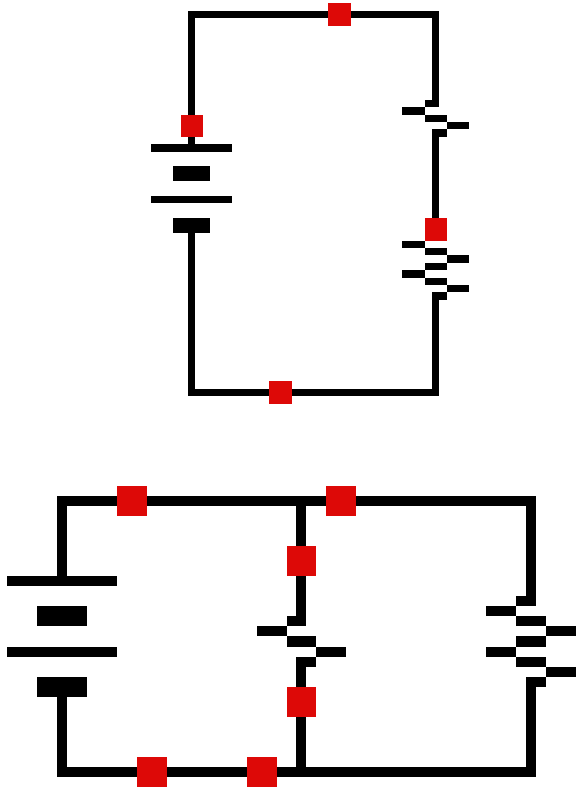
Background of Electrical Fires

- Fire incidents in the Philippines (NSO)
- Possible causes of Electrical Fire (Design, Selections, Installation and Maintenance)
- Common Installation Deficiencies Pictures
- Design Considerations
- Proper Installation Pictures

PDP Product Offerings

Basic Concepts of Electricity

- Electricity is the flow of electrons (current) through a conductor.
- Requires a source of power: usually a generating station.
- Travels in a closed circuit.
- When you become part of the circuit, the injury may be fatal.



Hazards Recognition

- Cords & Equipment

- Trip Hazards

- Electrical Panels

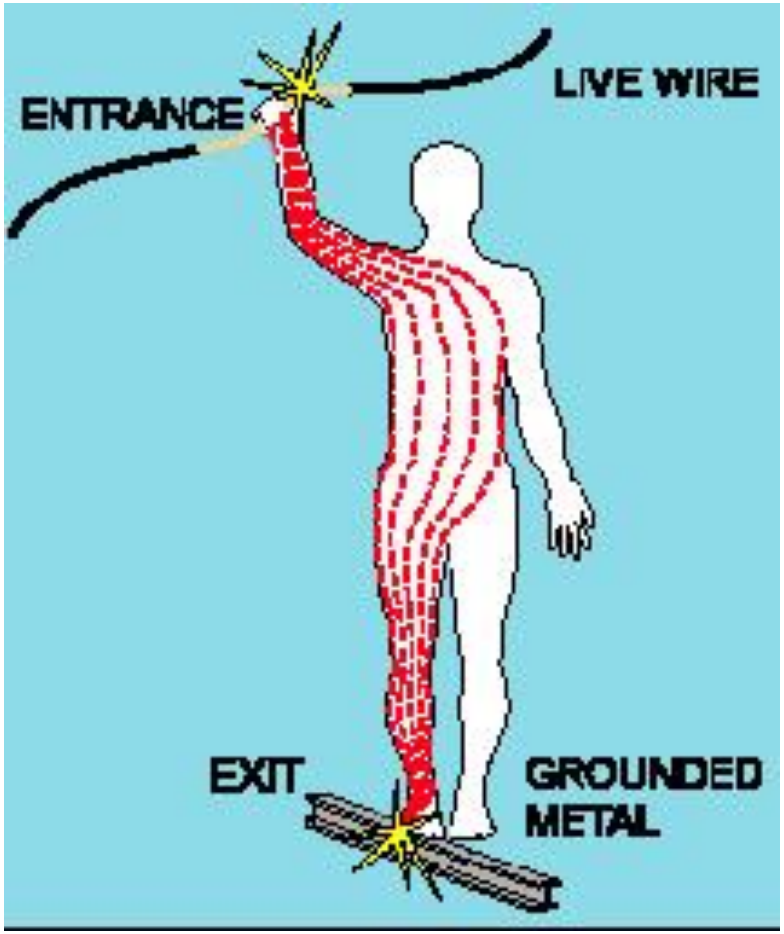
- Power Strips

Effects of Electricity on the Human Body

- The four major types of electrical injuries are:
  - Direct
    - Electrocution
    - Electrical Shock
    - Burns
  - Indirect
    - Falls

Electrical Shock

- Received when current passes through the body.
- Severity of the shock depends on:
- Path of current through the body.
- Amount of current flowing through the body.
- Length of time the body is in the circuit



Other effect are:

- Electrical Burns

- Arc-blast

- Falls

Electrical Hazard Protections

- Insulation
- Grounding
- Guarding
- Electrical protective devices
- Personal Protective Equipment
- Safe work practices

Insulation

- Plastic or rubber coverings that does not conduct electricity.
- Insulation prevents live wires from coming in contact with people thus protecting them form electrical shock.

Grounding

- Grounding is another method of protecting you from electric shock.
- However, it is normally a secondary protective measure.

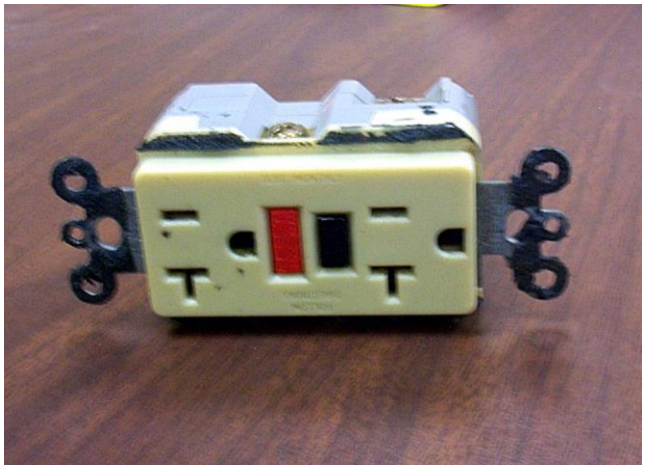
Ground Electrical Devices.

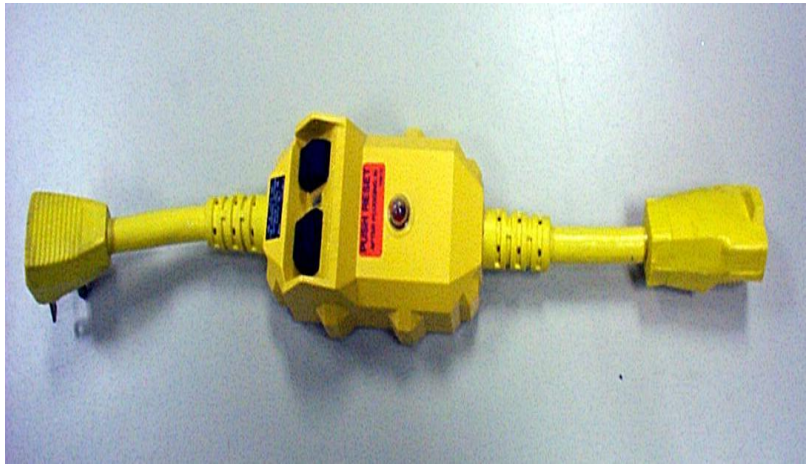
Guarding

- A type of isolation that uses various structures to close off live electrical parts.
- These structures include:
- Boxes
- Screens
- Covers
- Partitions

Ground Fault Circuit Interrupters (GFCI)

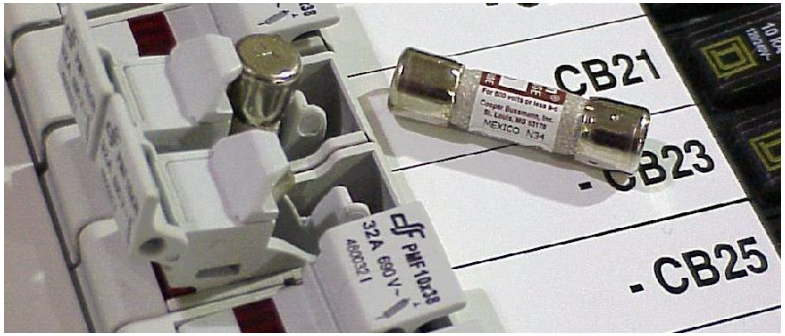
- Detects the difference in current between two circuits wires.
- This difference in current could happen when electrical equipment isn't working correctly.
- GFCI are set at about 5mA and are designed to protect workers and not equipment.





Fuses and Circuit Breakers

- Fuses and circuit breakers are intended primarily for the protection of conductors and equipment.
- They prevent over-heating of wires and components that might otherwise create hazards for operators.
- They also open the circuit under certain hazardous ground-fault conditions.



Personal Protective Equipment

phelps dodge
One time investment. Lifetime protection.

- Foot protection
  - Footwear will be marked “EH” if it’s approved for electrical work.
  - EH = Electrical Hazard
  - Footwear must be kept dry, even if it is marked “EH”

Personal Protective Equipment

- Head protection
  - Hard hat (insulated - nonconductive)
  - Class B & E.
  - Always wear your hat with the bill forward.
  - Do not store anything in the top of your hat while wearing it.

Personal Protective Equipment

- Hand protection
  - Rubber insulating gloves.
  - Classified by the level of voltage and protection they provide.
  - Should always be worn over rubber insulating gloves to provide the mechanical protection needed against cuts, abrasions, and punctures.

Personal Protective Equipment

- Eye Protection
  - Wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.

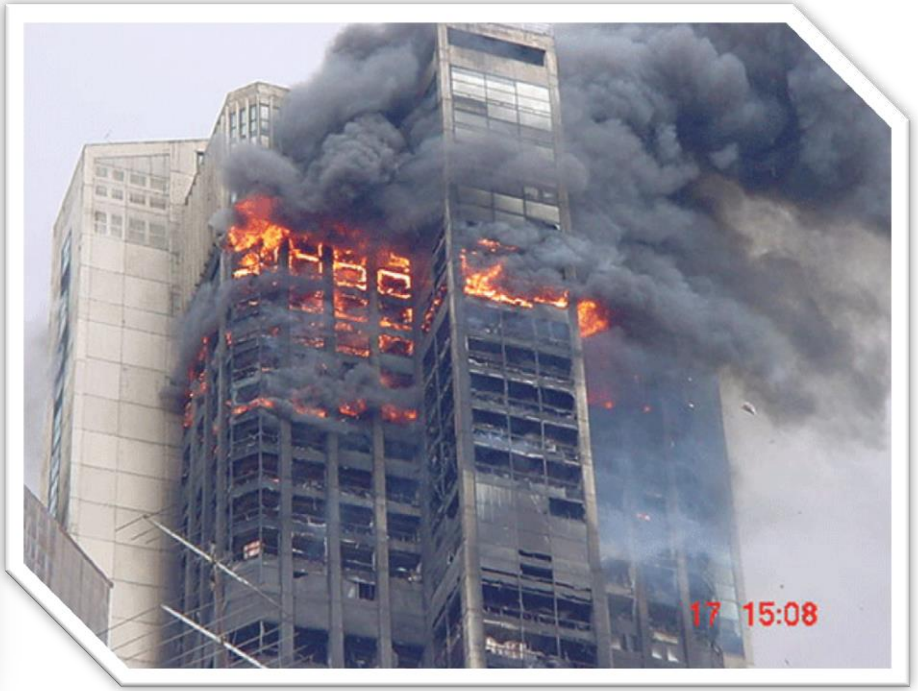
Electrical PPE with any of the following defects may not be used:

- If holes, tears, punctures, or cuts are present.
- Texture changes: Swelling, softening, hardening, or becoming sticky or inelastic.
- An embedded foreign object.
- Any other defect that damages the insulating properties.

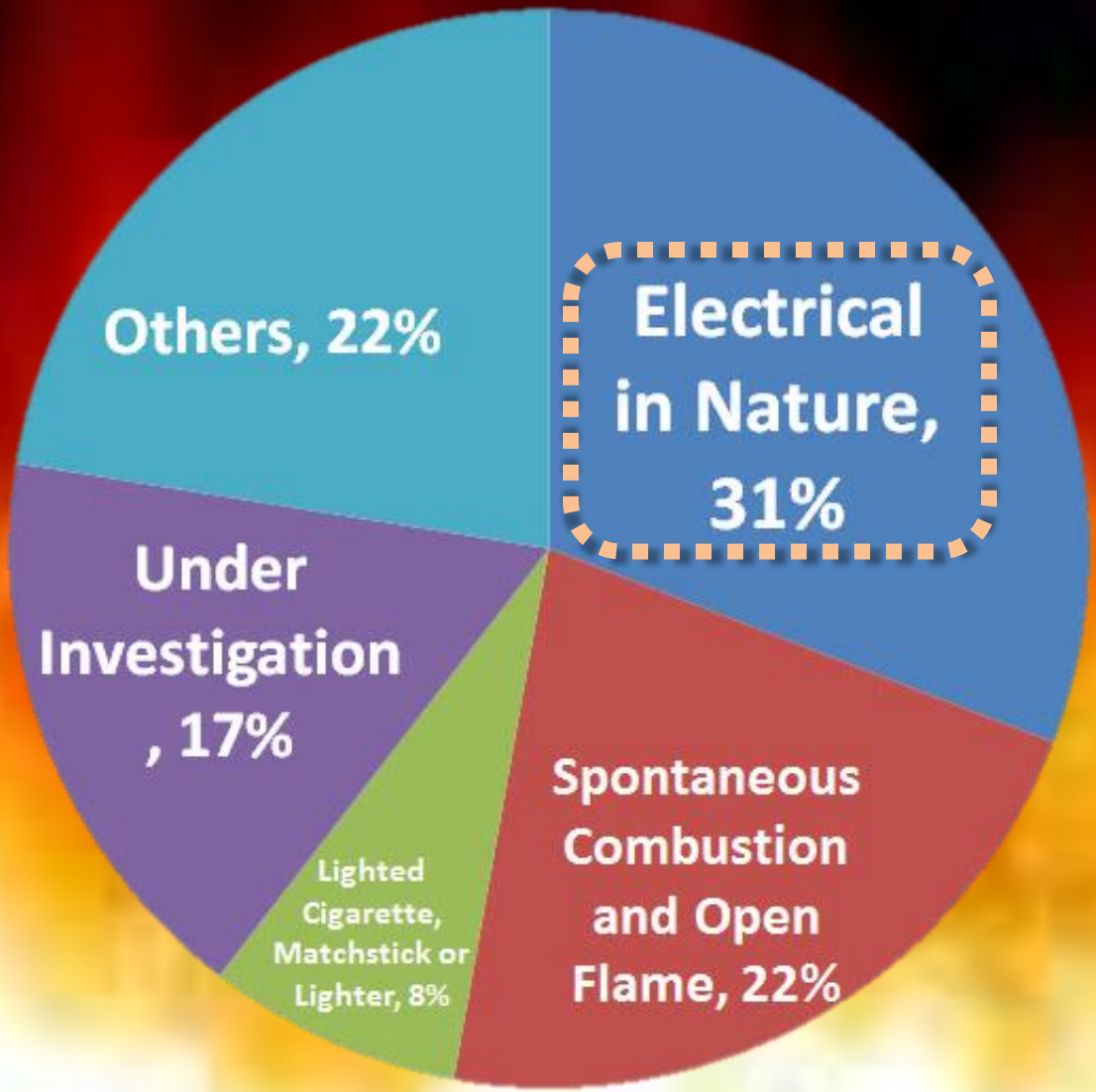
BACKGROUND OF ELECTRICAL FIRES

WHERE WOULD YOU RATHER BE?

phelps dodge
One time investment. Lifetime protection.



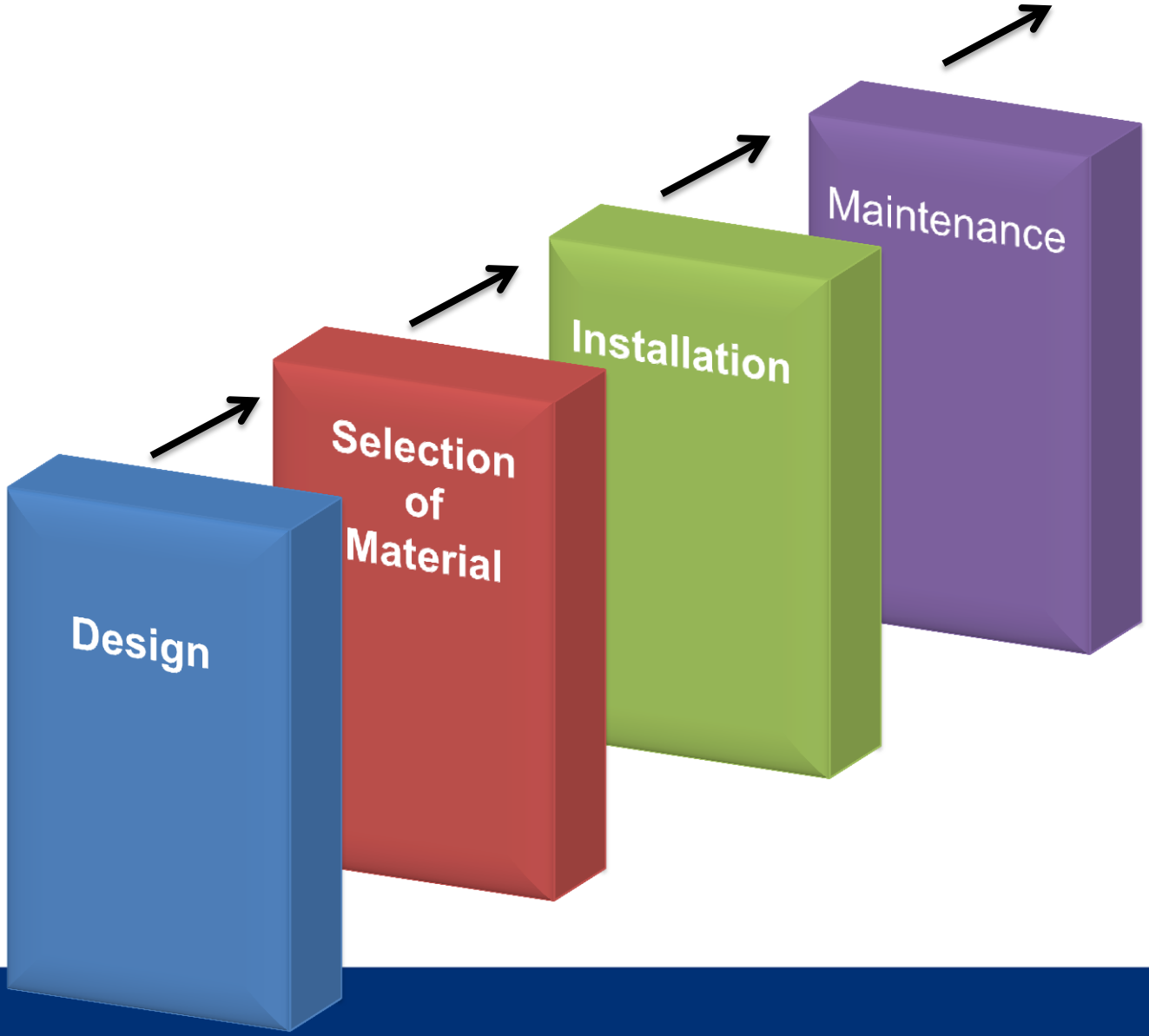
Total Number of Fire Incidence in the Philippines from 2005 to 2010



Balancing Act--- Cost vs. Safety & Reliability

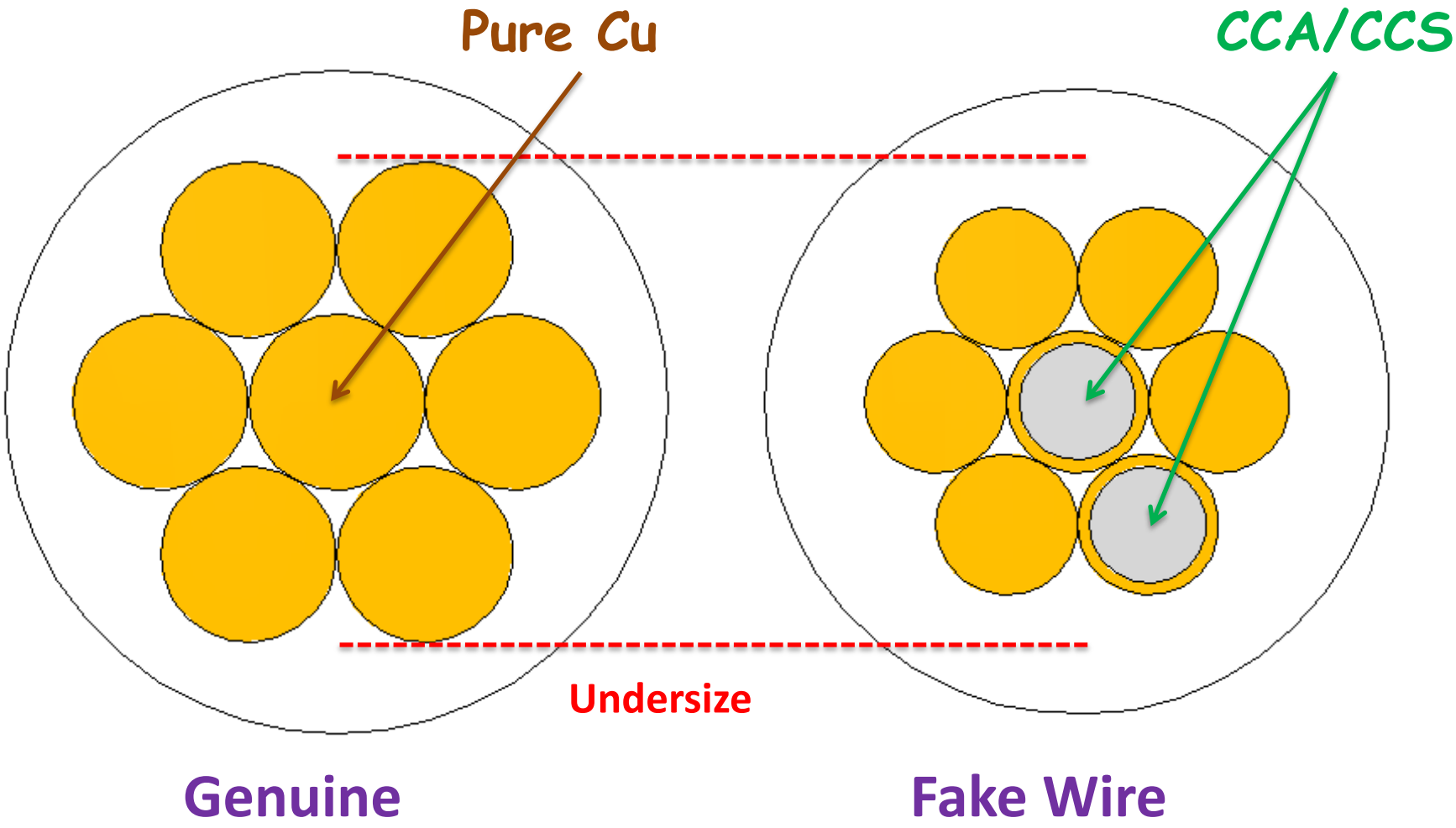
GRUESOME FACT

According to the Bureau of Fire Protection, every year more than **100 Filipinos die in fires** and hundreds more injured, and thousands more suffer as families lose their properties and valuables amounting to more than **P3 billion a year**.



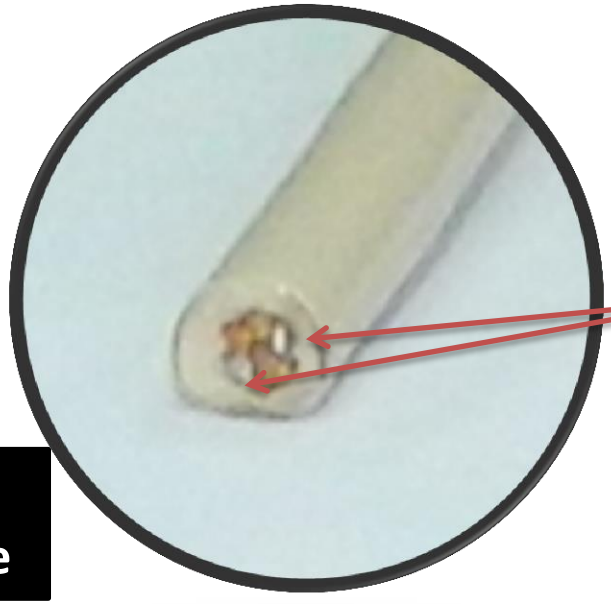
25

SUBSTANDARD & FAKE WIRES



Genuine Wire vs. Fake Wires

Plain view of cut wire

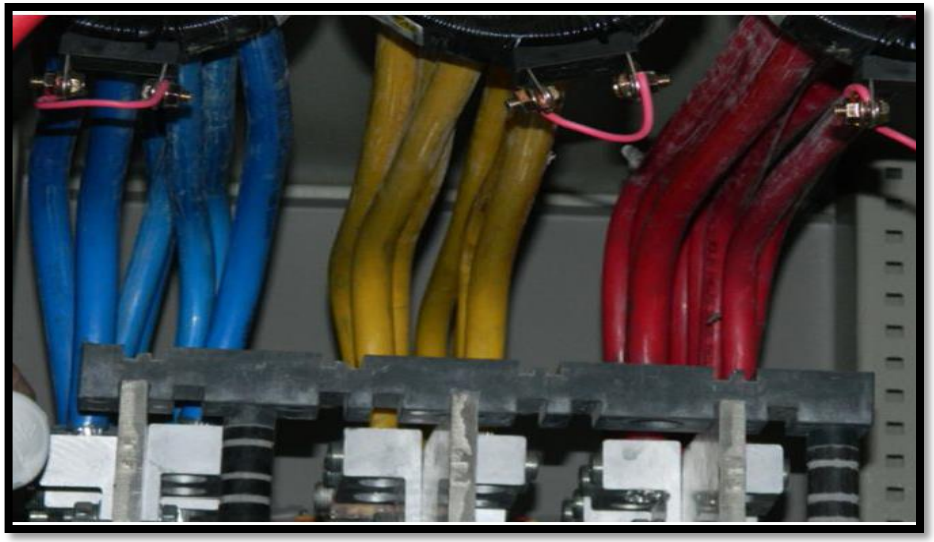


2 Strands of CCA

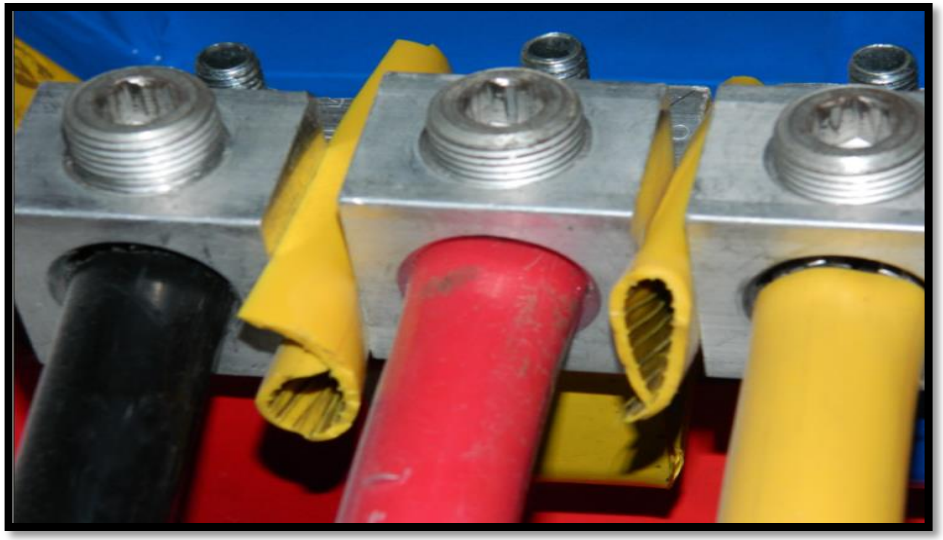
Cross Section view of cut wire

INSTALLATION ISSUES

installation BLOOPERS



- **Overbending of cables inside the panels**

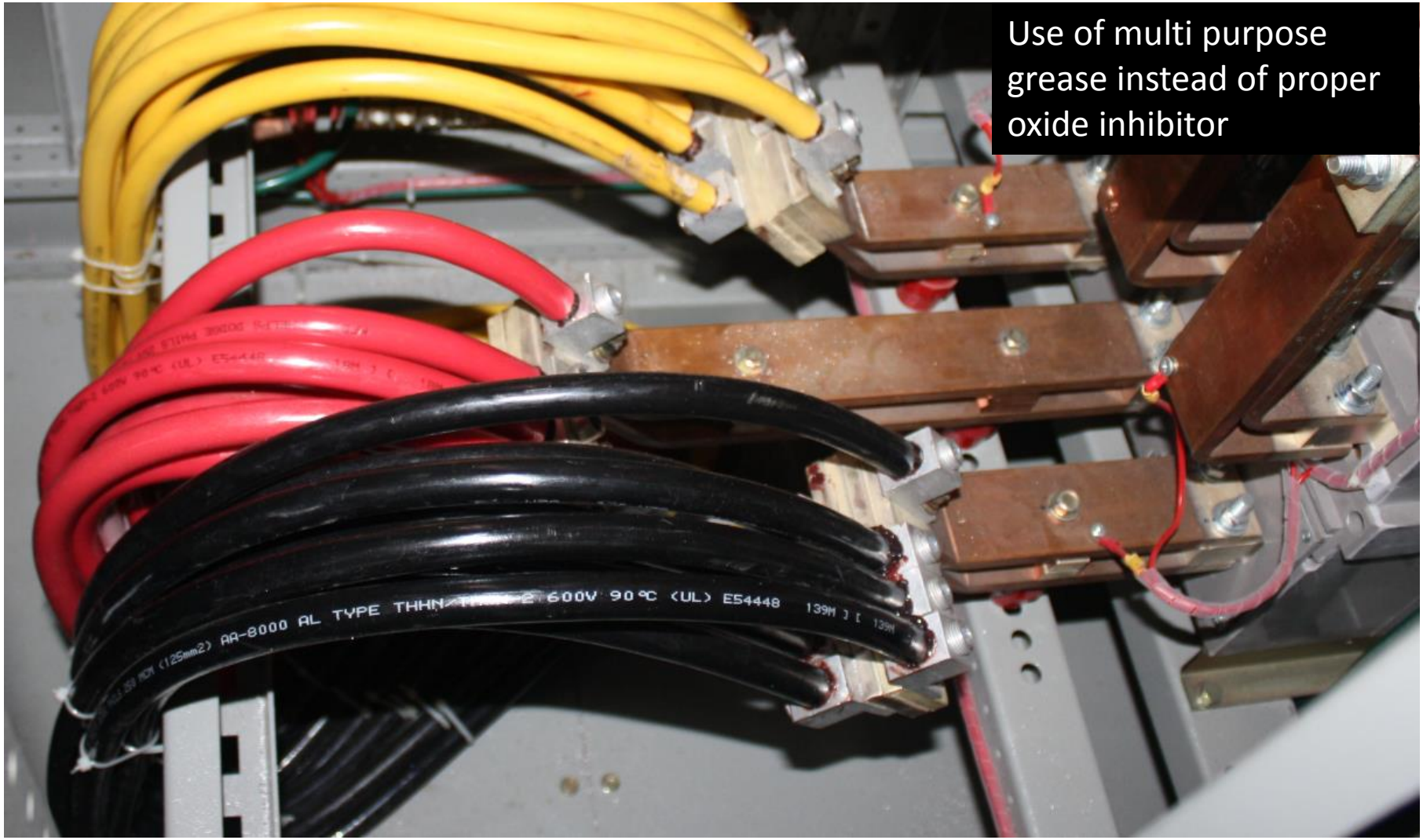


- **Using of stripped PVC jacket as separators**

installation **BLOOPERS**

RISKY

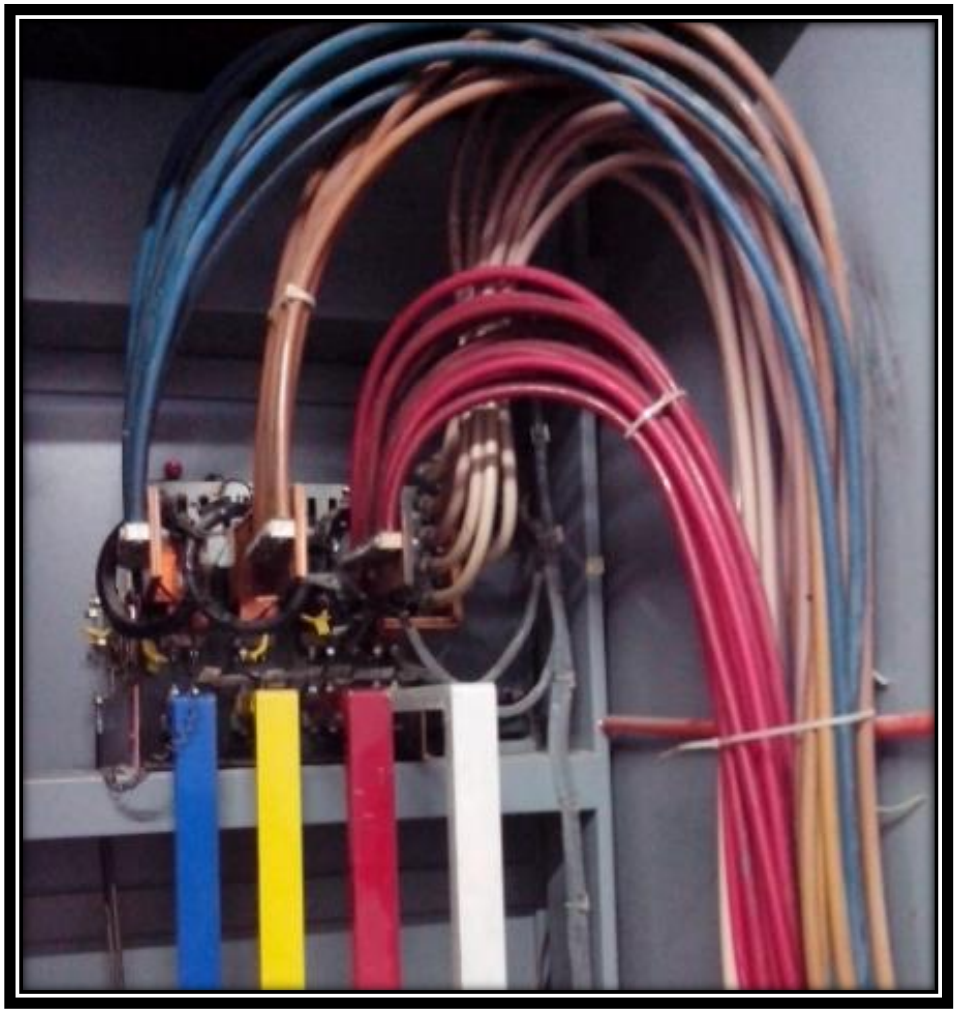
installation **BLOOPERS**



installation **BLOOPERS**

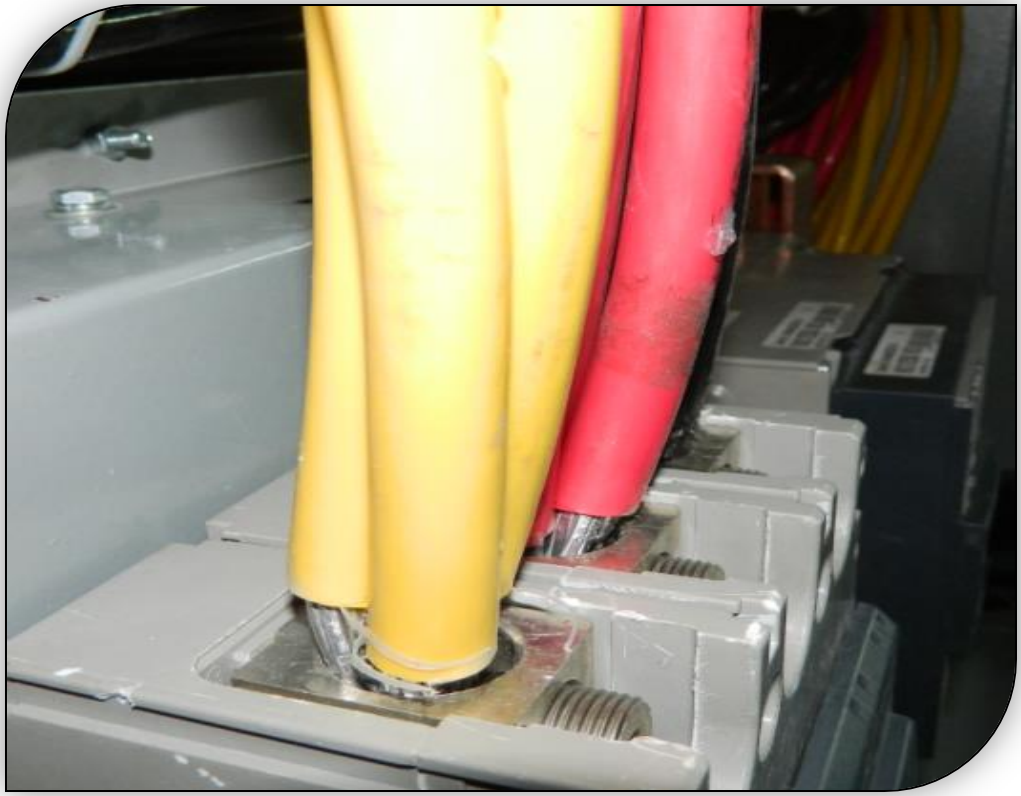
- **Improper cable grouping that may result to overheating of the cables**

installation BLOOPERS



Cable operating with high temperature

installation **BLOOPERS**



RISKY

- **Three (3) conductor terminated in one terminal lug.**

installation **BLOOPERS**

RISKY

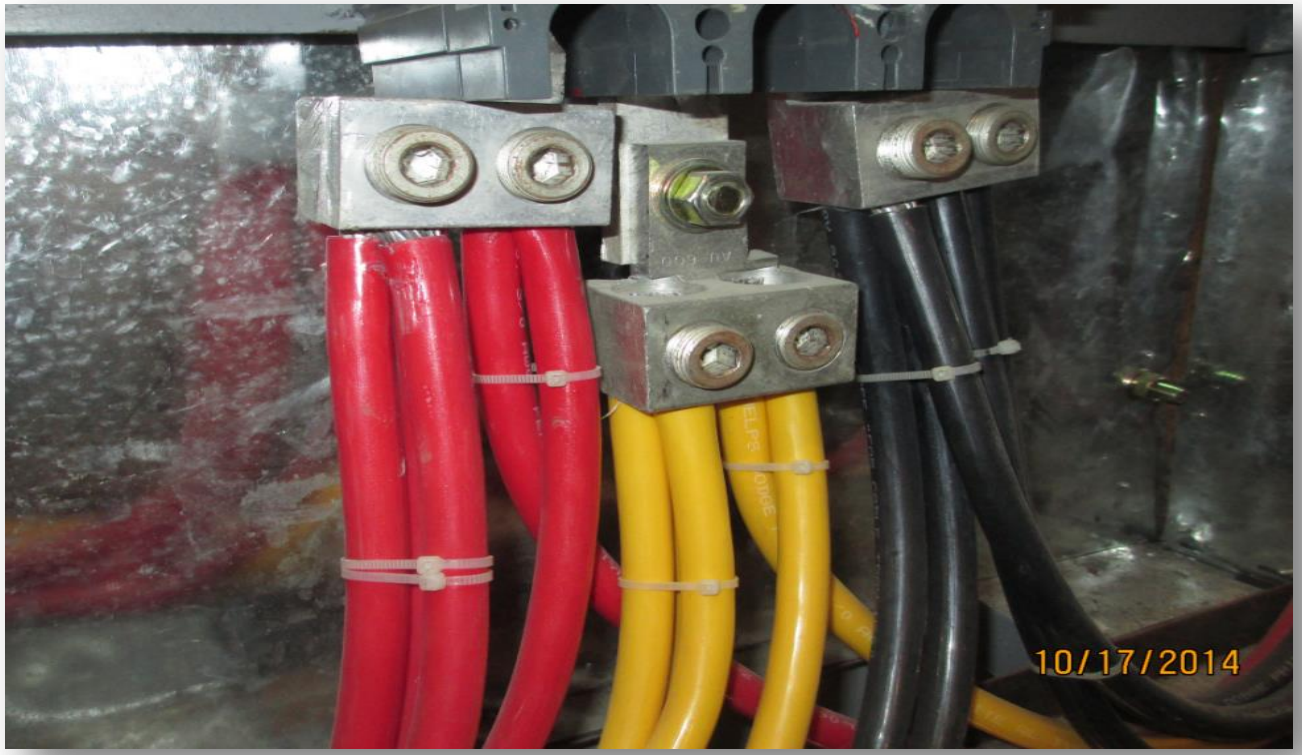
- **Wrong size of terminal lugs was used resulting to stripping of conductor strands.**

installation BLOOPERS

Paralleling of DISSIMILAR size cable

installation **BLOOPERS**

installation **BLOOPERS**



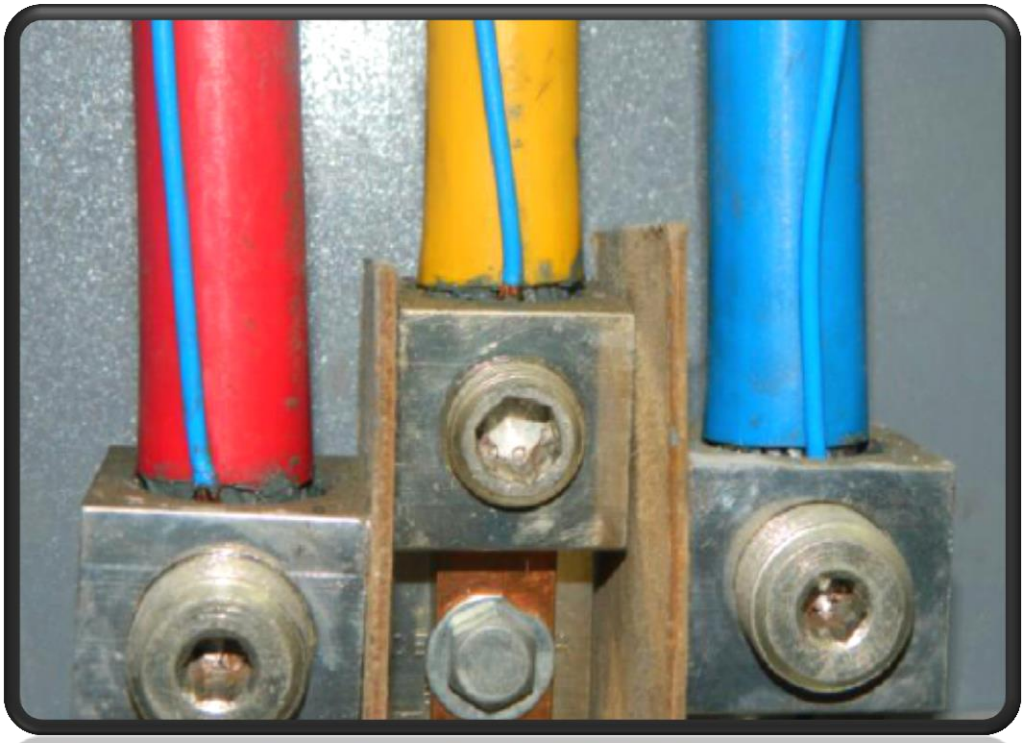
- **Termination of Two-conductor (2) in one terminal lug.**

installation **BLOOPERS**

RISKY

- **Overbending of the cables due to the improper clearances inside the panels.**

installation **BLOOPERS**



Copper conductor for metering is directly connected to the aluminum cables. This could lead to galvanic corrosion. In addition, the 3.5mm2 conductor is not designed to be terminated with big conductor. The 3.5mm2 conductor may be damaged due to excessive torque applied on the larger cable.

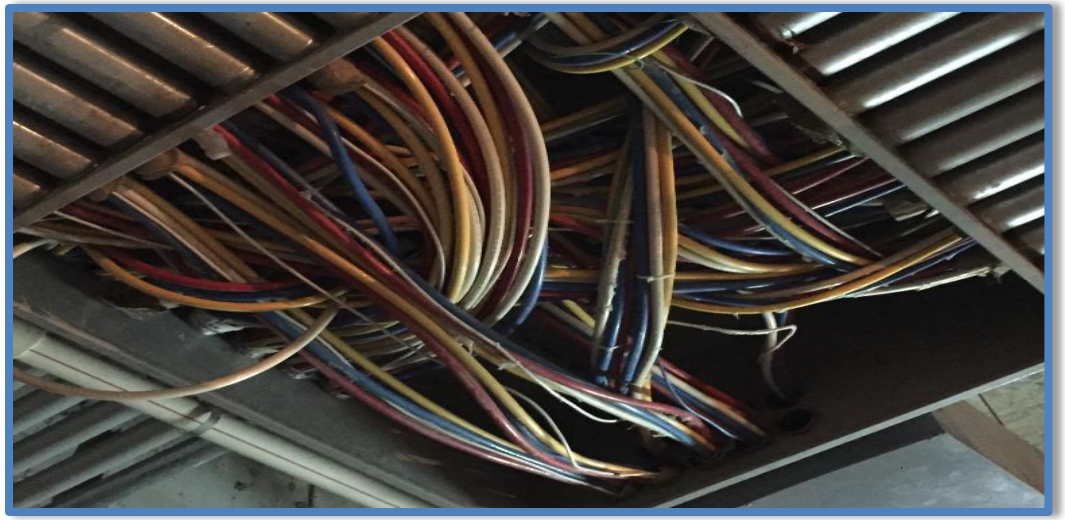
installation **BLOOPERS**

RISKY

- **Cable congestion inside the switchgears**

installation BLOOPERS

phelps dodge
One time investment. Lifetime protection.



Cable congestion on pull boxes

Overbending of cable on pull boxes

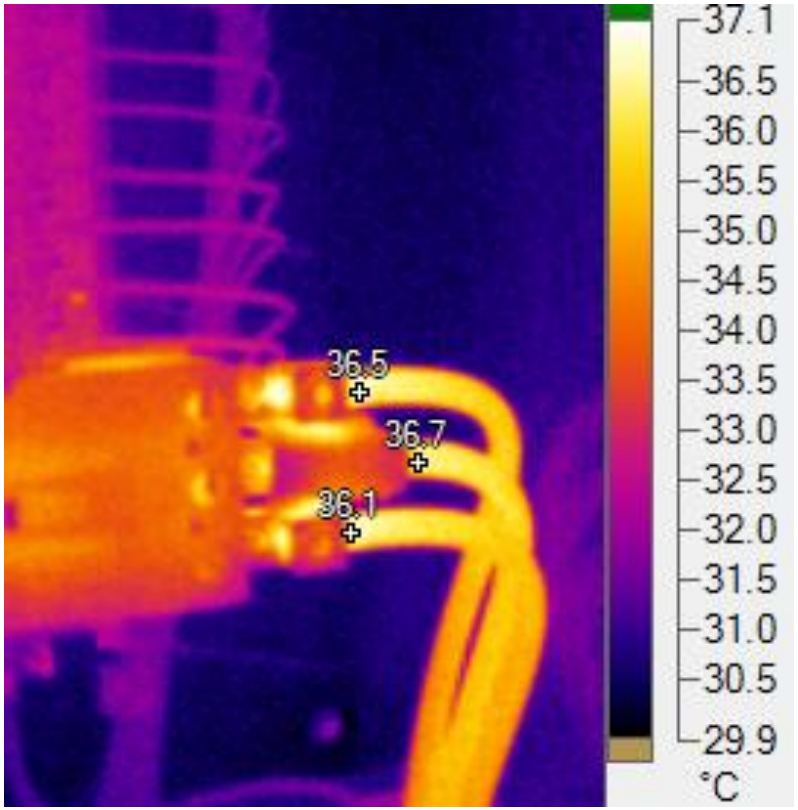
installation BLOOPERS

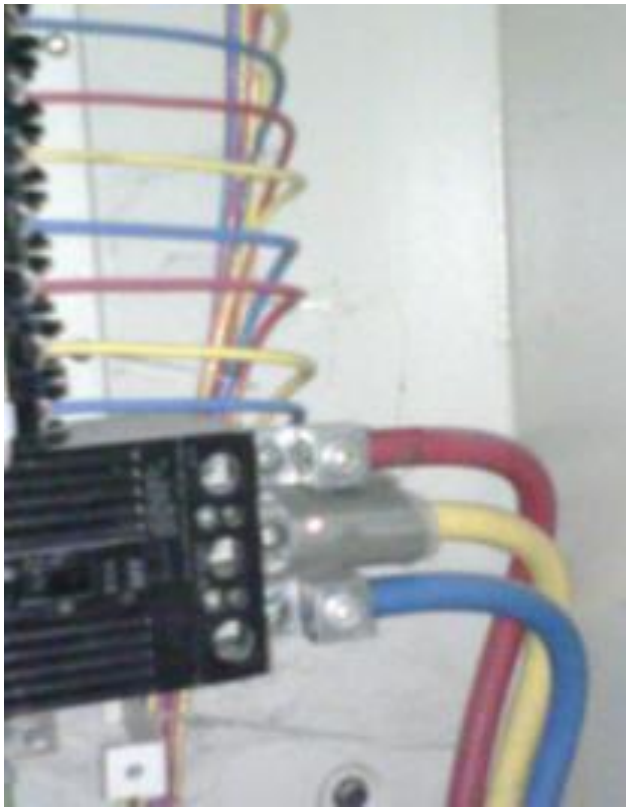
phelps dodge
One time investment. Lifetime protection.

Improper cable grouping

Cable damage during cable pulling and installation

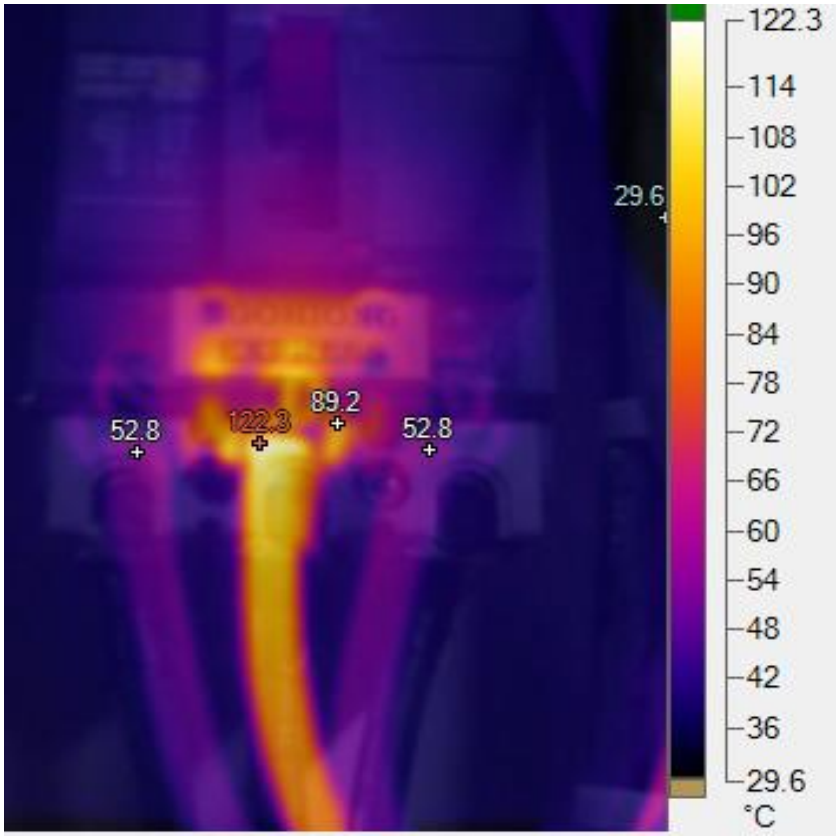
installation **BLOOPERS**





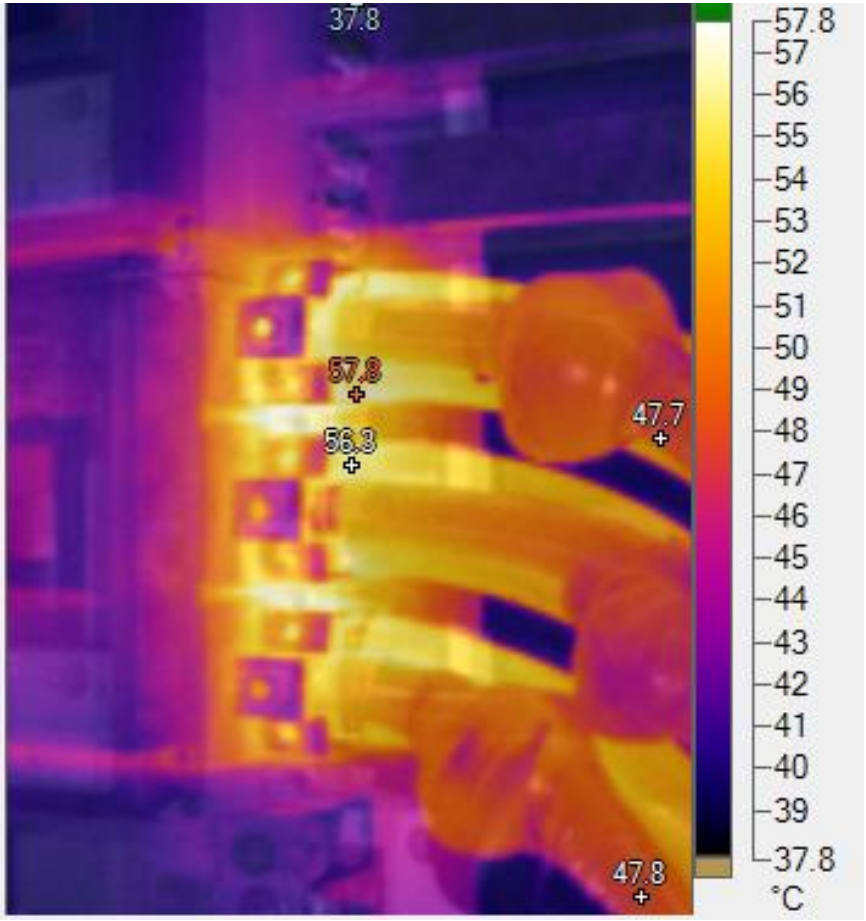
Loose connection

installation **BLOOPERS**



- **Overheating of the cable due to unbalanced loading**

installation **BLOOPERS**



DESIGN CONSIDERATIONS TO AVOID INSTALLATION DEFICIENCIES

phelps dodge

One time investment. Lifetime protection.

Wire-Bending Space in Panelboard: The enclosure for a panelboard shall have **top and bottom wire-bending space** in accordance with **Table 3.12.1.6(b)** for the largest conductor entering or leaving the enclosure. **Side wire-bending space** shall be in accordance with **Table 3.12.1.6(a)** for the largest conductor to be terminated in that space.

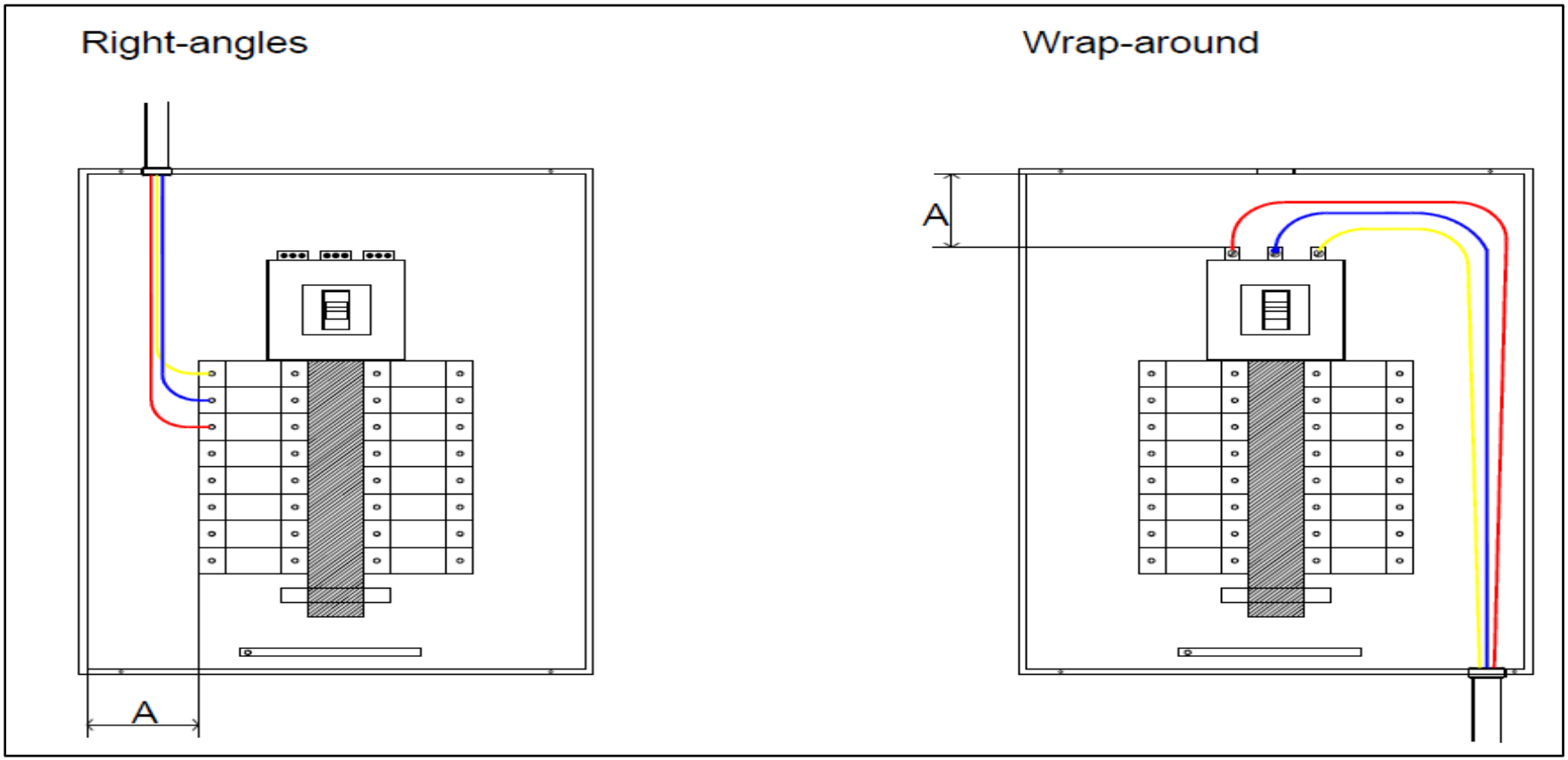


Table 3.12.1.6(a) Minimum Space for Wire-Bending and Width of wiring Gutter

Rating of CB	Wire Size		Wire per Terminal									
			1		2		3		4		5	
	AWG/Kcmil	mm²	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
30-60	8-6	8-14	40	1-1/2	-	-	-	-	-	-	-	-
70-100	4-3	22	50	2	-	-	-	-	-	-	-	-
110	2	30	65	2-1/2	-	-	-	-	-	-	-	-
125	1	38	75	3	-	-	-	-	-	-	-	-
150-175	1/0-2/0	50-60	90	3-1/2	-	-	-	-	-	-	-	-
200-225	3/0-4/0	80-100	100	4	150	5	-	-	-	-	-	-
250	250	125	115	4-1/2	150	6	200	8	-	-	-	-
300	300-350	150-175	125	5	200	6	250	8	300	10	-	-
350-400	400-500	200-250	150	6	200	8	250	10	300	12	-	-
500	600-700	325-375	200	8	250	8	300	10	350	12	400	14
600	750-900	500	200	8	300	10	350	12	400	14	450	16
600	1000-1250	500-600	250	10	300	12	350	14	-	-	-	-

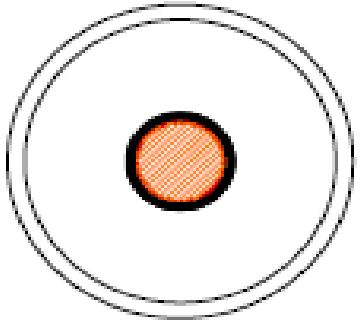
Number and Size of Conductor in Raceway

Article 3.0.1.17: The **number and size of conductor** in any raceway shall not be more than will permit dissipation of the heat and ready installation or withdrawal of the conductor without damage to the conductors or to their installation.

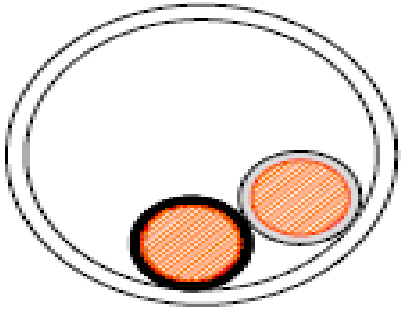
Table 9.1.1.1 Percent of Cross Section of Conduit and Tubing of Conductor

Number of Conductor	Percent Fill
1	53%
2	31%
Over 2	41%

One Conductor 53% fills



Two Conductors Fills



Three or more Conductors 40%

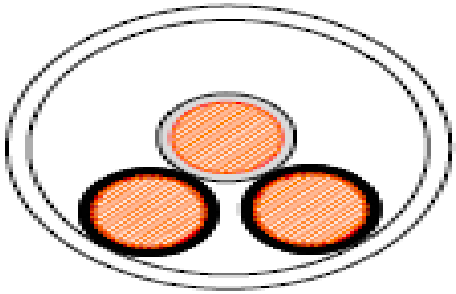


Table C4 Maximum Number of Conductor and Fixture Wires in Conduit

Conduit Size	mm		15	20	25	32	40	50	65	80	90	100
	Inches		1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4
	Conductor Size											
THHN, THWN, THWN-2	2.0	14	14	24	39	68	91	149	211	326	436	562
	3.5	12	10	17	29	49	67	109	154	238	318	410
	5.5	10	6	11	18	31	42	68	97	150	200	258
	8	8	3	6	10	18	24	39	56	86	115	149
	14	6	2	4	7	13	17	28	40	62	83	107
	22	4	1	3	4	8	10	17	25	38	51	66
	30	2	1	1	3	5	7	12	17	27	36	47
	38	1	1	1	2	4	5	9	13	20	27	35
	50	1/0	1	1	1	3	4	8	11	17	23	29
	60	2/0	1	1	1	3	4	6	9	14	19	24
	80	3/0		1	1	2	3	5	7	12	16	20
	100	4/0		1	1	1	2	4	6	9	13	17
	125	250			1	1	1	3	5	8	10	13
	150	300			1	1	1	3	4	7	9	12
	175	350			1	1	1	2	4	6	8	10
	200	400			1	1	1	2	3	5	7	9
	250	500			1	1	1	1	3	4	6	7
	325	700			1	1	1	1	2	3	5	6
	375	750			1	1	1	1	1	3	4	5
	400	800			1	1	1	1	1	3	4	5
	500	1000				1	1	1	1	2	3	4

CABLE TRAY WIRING
(Tre-foil Configuration)

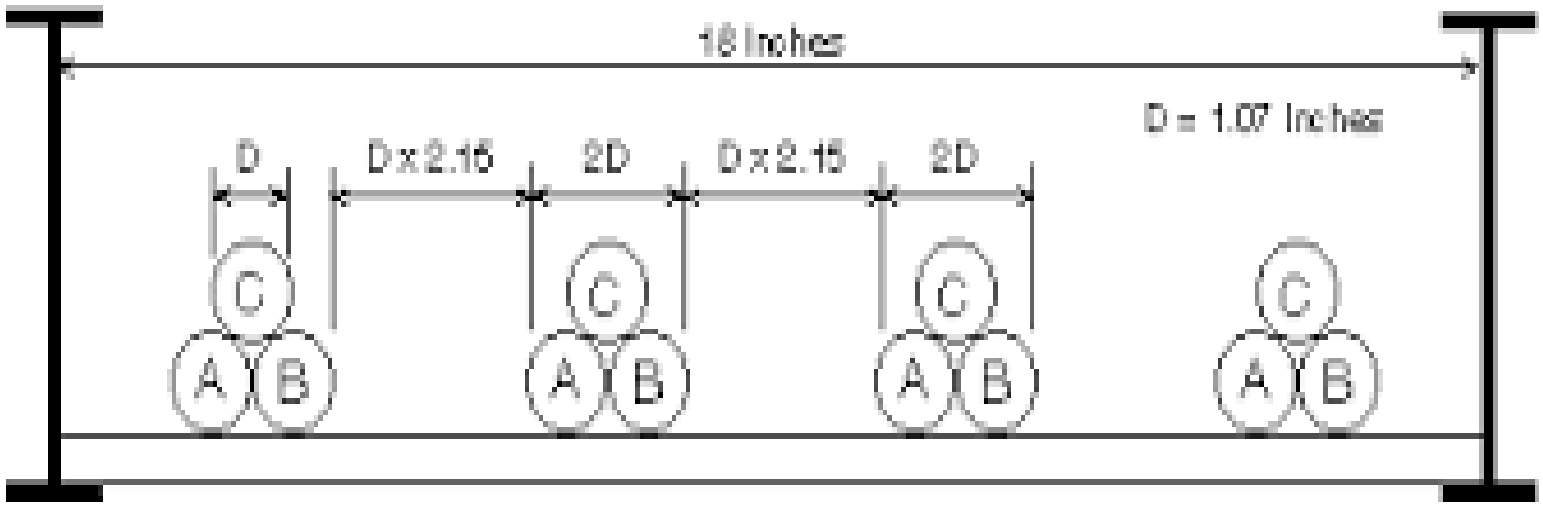
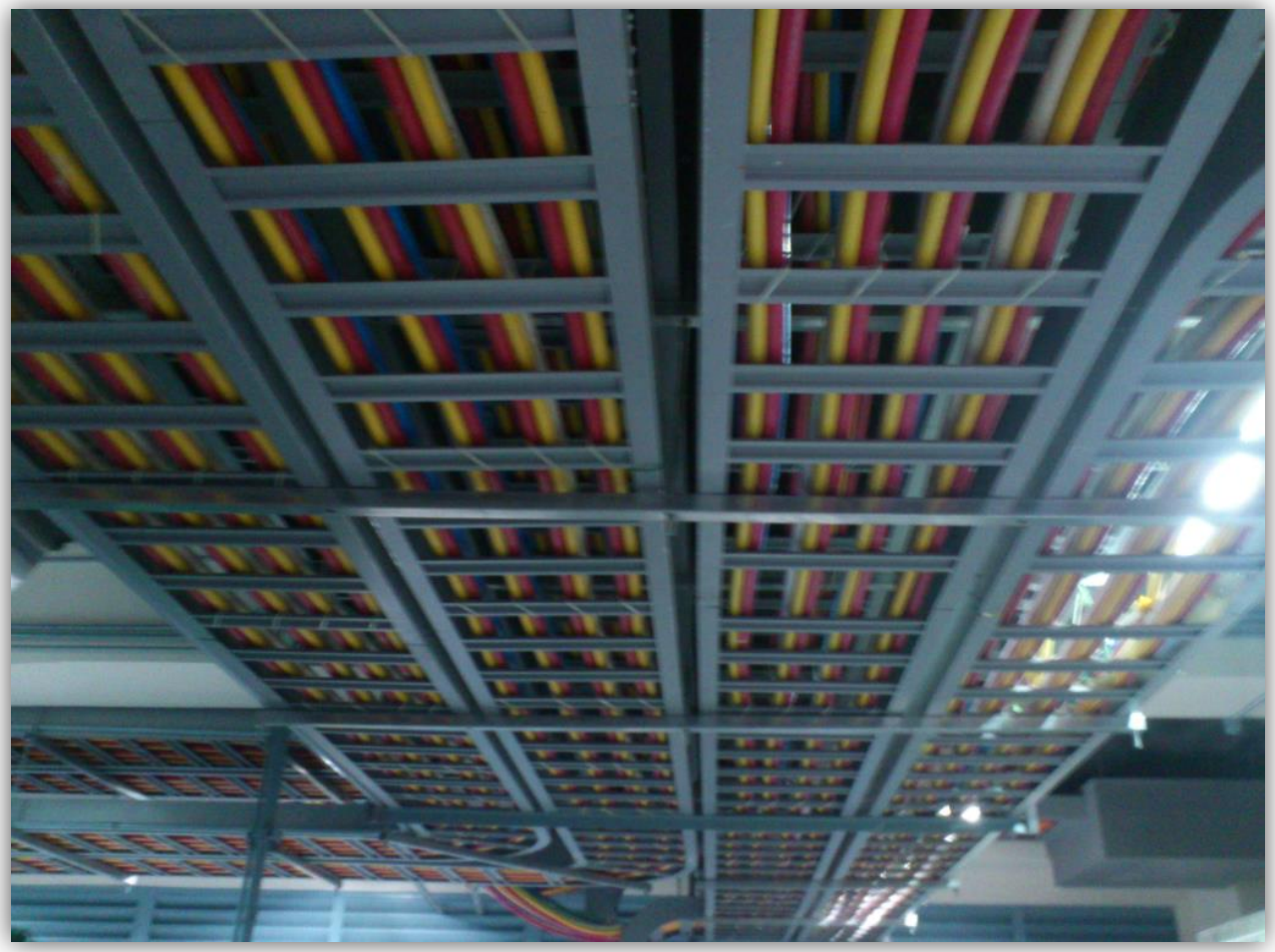
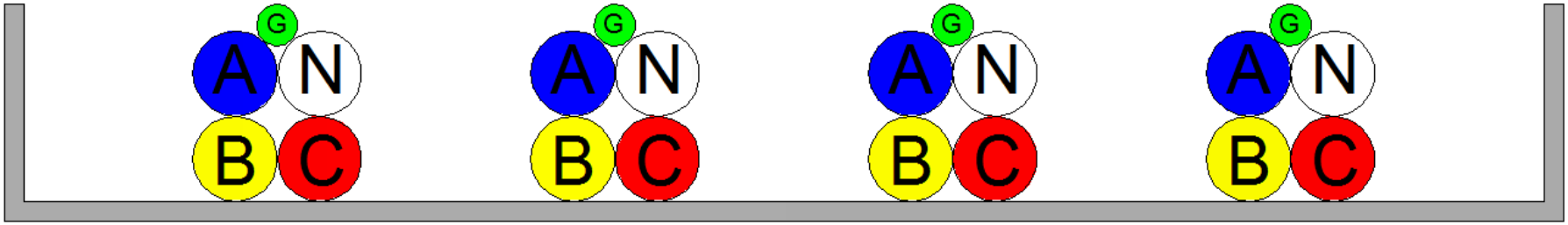


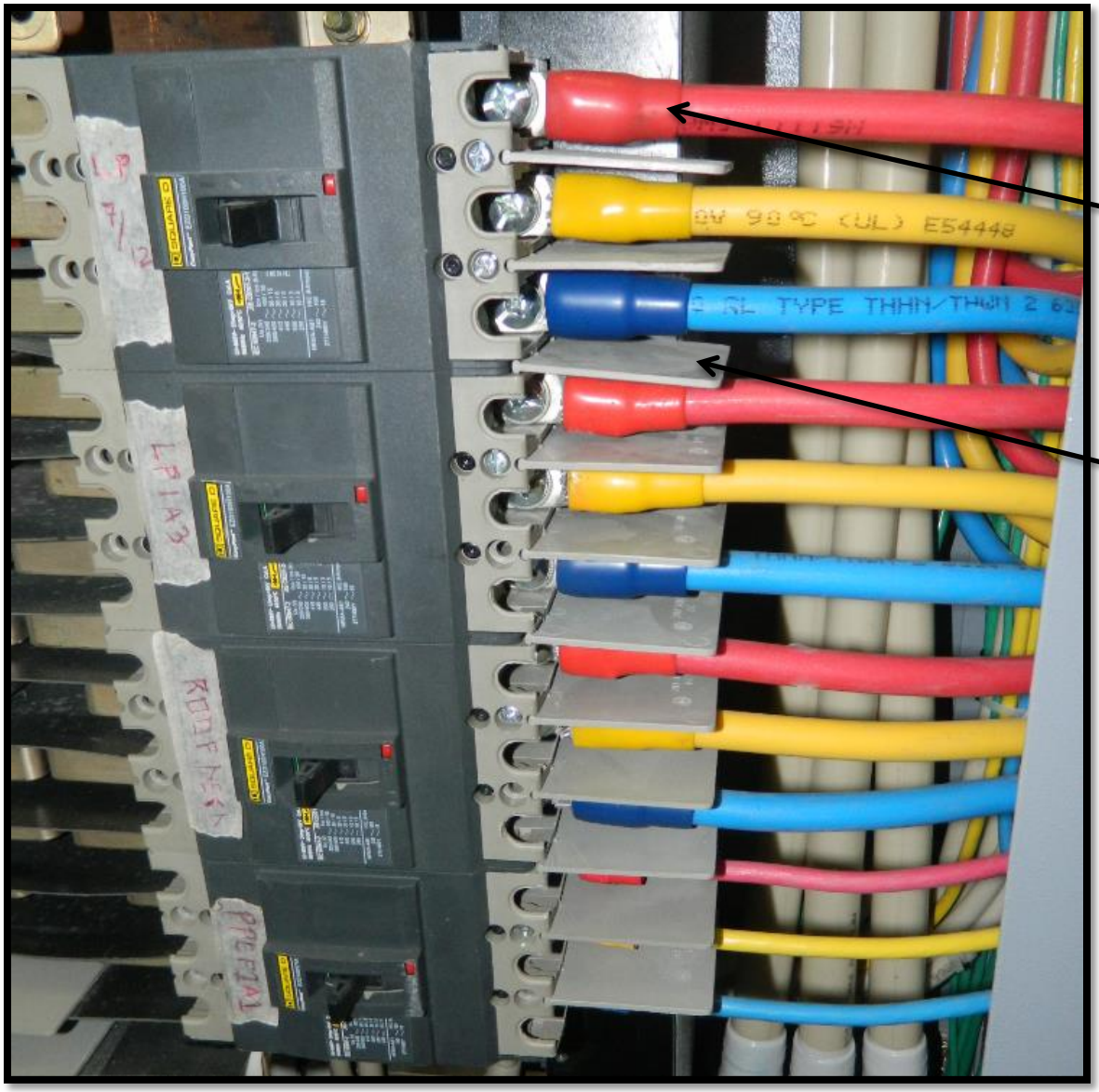
Figure 3

GOOD INSTALLATION PRACTICES






02/26/2014 11:26


Connector Insulation
Electrical Separator

PDP PRODUCT OFFERINGS

METAL-CLAD CABLE (TYPE MC)

phelps dodge

One time investment. Lifetime protection.

TECHNICAL DEFINITION OF TYPE MC CABLE

(NEC 330/PEC 3.30)

A factory assembly of insulated circuit conductors, enclosed in an armor of interlocking metal type.

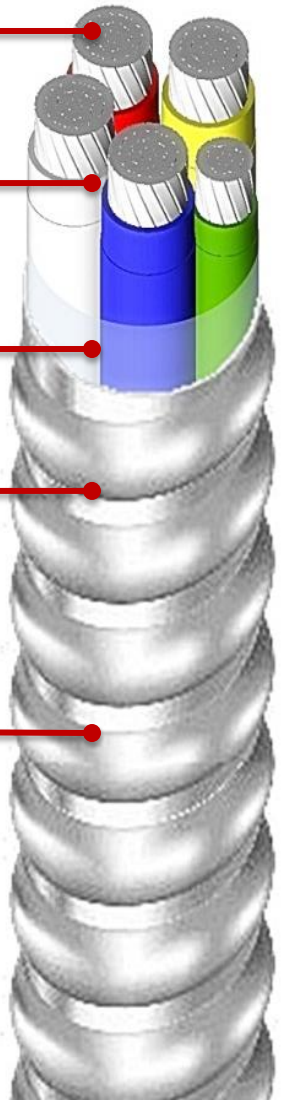
CONDUCTOR:
COPPER OR ALUMINUM

INSULATION:
PVC, PVC/NYLON or XLPE

CORE WRAP:
MYLAR TAPE

ARMOR:
ALUMINUM STRIP ARMOR
or STEEL STRIP ARMOR

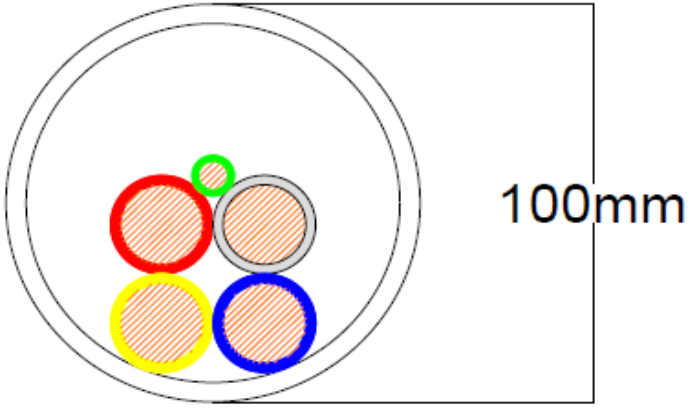
JACKET:
WITH (FOR OUTDOOR) or
WITHOUT (FOR INDOOR)
PVC OVERALL JACKET



CORE:
SINGLE CORE or
MULTICORE CABLE

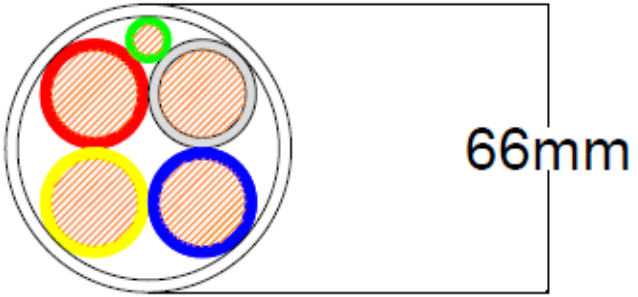
VOLTAGE RATING:
LOW VOLTAGE or
MEDUIM VOLTAGE

COST COMPARISON



Copper Cable in 3 ½" Conduit
(4x1C -500MCM + 1G 2AWG)

VS.

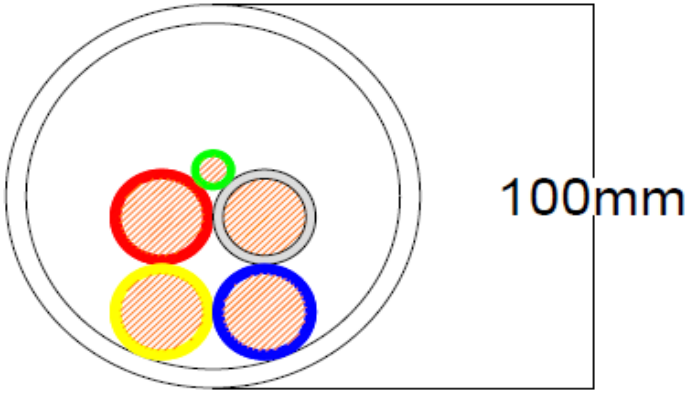


MC Copper Cable
(4C -500MCM + 1G 2AWG)

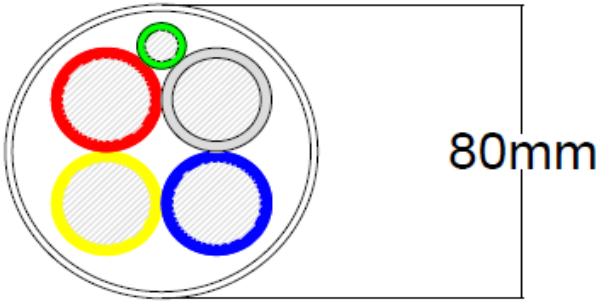
Up to 19% SAVINGS

BY USING MC COPPER CABLE

COST COMPARISON



VS.



Copper Cable in 3 ½" Conduit
(4x1C -500MCM + 1G 2AWG)

MC Aluminum Cable
(4C -750MCM + 1G 1/0AWG)

Up to 46% SAVINGS

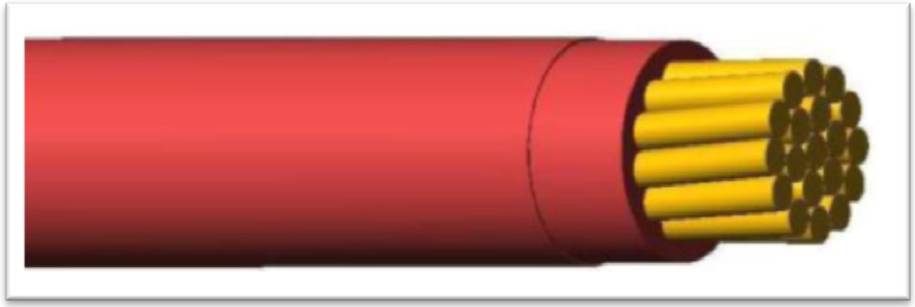
BY USING MC ALUMINUM CABLE

PD ALUMILITE (ALUMINUM 8000 SERIES)

phelps dodge

One time investment. Lifetime protection.

PD ALUMILITE



COPPER

PD ALUMILITE

	COPPER	ALUMINUM
Conductor	COMPRESS Stranded Copper Conductor	COMPACT Stranded AA 8000 Series Al. Conductor
Insulation	Lead Free PVC Insulation (THHN/THWN-2)	Lead Free PVC Insulation (THHN/THWN-2)
Jacket	Abrasion Resistant Nylon Jacket	Abrasion Resistant Nylon Jacket

For sizes 6AWG (14mm^2) & bigger.

ADVANTAGES OF PDP ALUMINUM BUILDING WIRES

phelps dodge
One time investment. Lifetime protection.

1. It is **COST EFFECTIVE** versus copper.
2. It is **LIGHTER** – it takes **ONE KILOGRAM OF ALUMINUM** to equal the current carrying capacity of **TWO KILOGRAMS OF COPPER.**
3. It is **SAFE and RELIABLE** as copper and it is widely used in **USA and Canada** since **1987**.
4. Insulation is made of **HIGH TEMPERATURE LEAD-FREE INSULATION TYPE THHN/THWN-2**

PROJECT REFERENCES

phelps dodge
One time investment. Lifetime protection.

MEGAWORLD

Ayala Land, Inc.

Rustan's
SINCE 1952

CÍRCULO VERDE

CSI

VISTA LAND

SM

KCC

PROJECT REFERENCES

phelps dodge
One time investment. Lifetime protection.

SM ARENA

SM AURA PREMIER

EASTWOOD MALL

PROJECT REFERENCES

phelps dodge
One time investment. Lifetime protection.

BASELINE RESIDENCES (Cebu)

CITYSCAPE TOWER CONDOMINIUM 2 (Cebu)

FILINVEST ALABANG BUILDING

FILINVEST PLAZA E

SOLAR CABLES

phelps dodge

One time investment. Lifetime protection.

SOLAR CABLES

EXZHELLENT® SOLAR

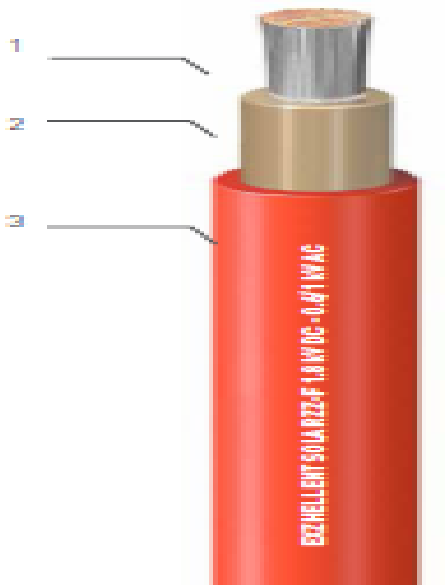
ZZ-F (PV1-F)

1.8 kV DC – 0.6/1 kV AC

APPLICATIONS:

Exzhellent® Solar ZZ-F (PV1-F) cables are designed to withstand the demanding environmental conditions that arise in any fixed, mobile, roof or architecturally integrated photovoltaic installation.
Not recommended for installation underground, whether in counduit or directly buried.
Exzhellent® Solar guarantees the maximum efficiency in the energy transmission throughout the full service life of your installation.

CONSTRUCTION:

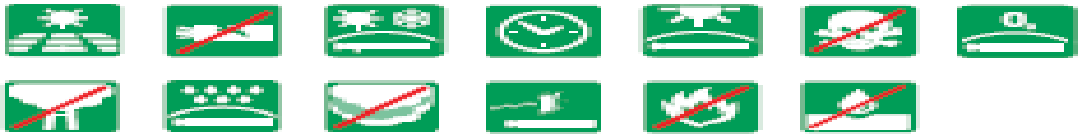


1. Conductor:
Tinned copper Class 5 for mobile installation (-F)
2. Insulation:
Halogen-free cross-linked elastomer (Z)
3. Jacket:
Halogen-free cross-linked elastomer (Z)

STANDARDS:
TÜV 2 Pfg 1169/08.2007
UTE C 32-502

VOLTAGE:
1.8 kV DC – 0.6/1 kV AC

FEATURES:

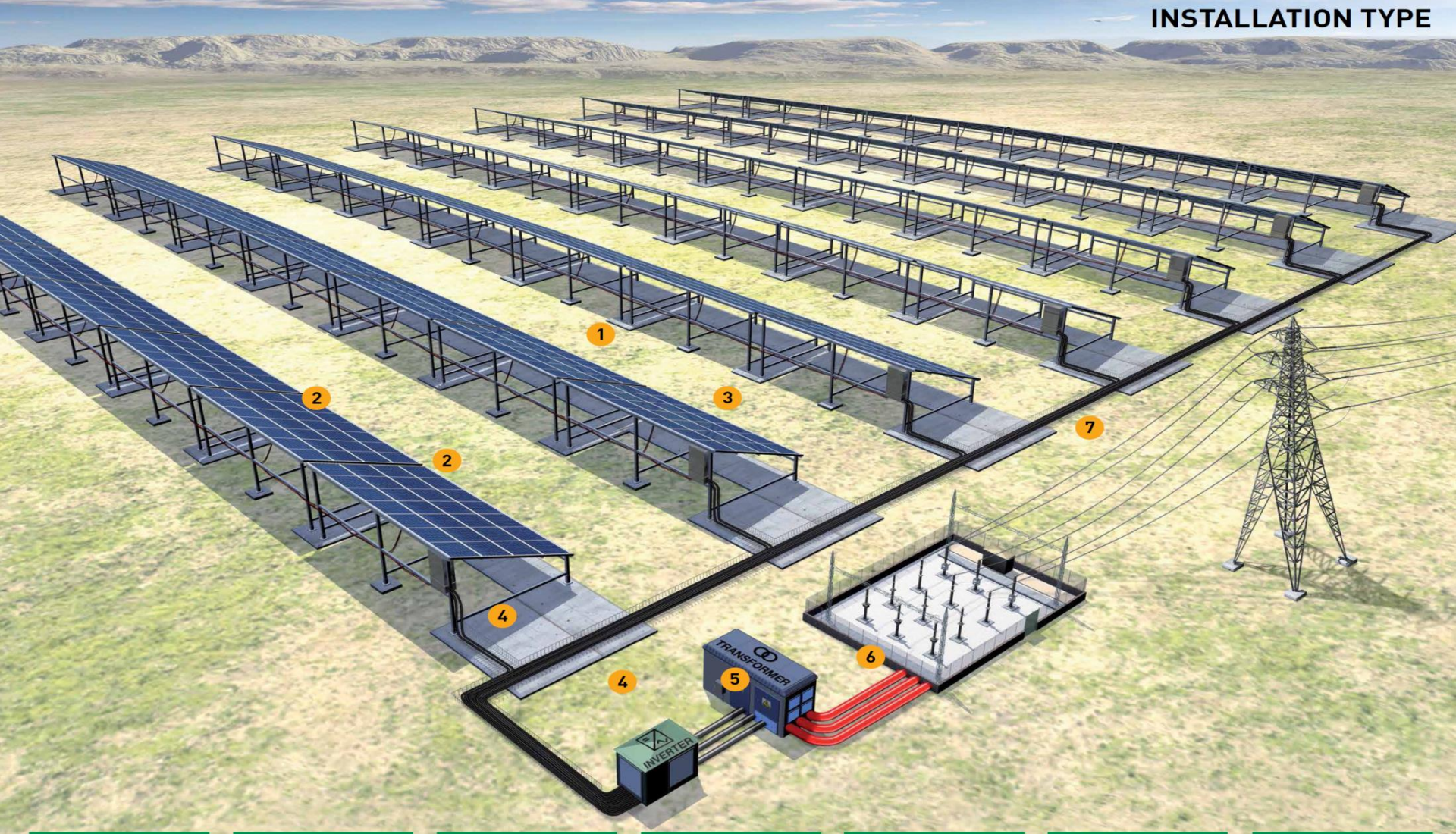


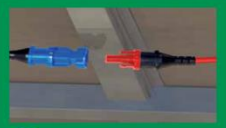
APPROVALS:

PDP VALUE ENGINEERING RECOMMENDATIONS FOR SOLAR CABLES

- ✓ Use of **ALUMINUM CONDUCTORS** for low voltage (LV) AC cables instead of copper conductors
- ✓ Use of **ALUMINUM CONDUCTORS** for medium voltage cables up to 13.8 kV
- ✓ Use of **TUV COMPLIANT SOLAR PV WIRES** (4 mm^2 -10 mm^2)
- ✓ Use of ACSR with **ALUMINUM CLAD STEEL** (corrosion resistant)
- ✓ **COPPER** for control and instrumentation cables

INSTALLATION TYPE

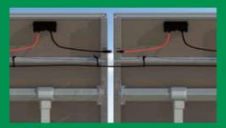




1 Easy pluggable system

ex*Zhellent* clickconnect

MC4 type • Amps 40A DC • contact resistance <1m Ω • -40 ºC to 105 ºC • IP68 • 2.5 to 10 mm² cross-sections Customised cable lengths



2 Connection between photovoltaic modules and panels

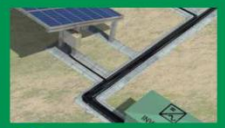
ex*Zhellent* SOLAR ZZ-F (PV1-F)
1.8 kV DC - 0.6/1 kV AC

Standard cross-sections from 1 x 2.5 to 1 x 35 mm² • Up to 240 mm² upon customer request • TÜV certificate

3 LV DC installation between panels and connection boxes

ex*Zhellent* SOLAR ZZ-F (PV1-F)
1.8 kV DC - 0.6/1 kV AC

Standard cross-sections from 1 x 2.5 to 1 x 35 mm² • Up to 240 mm² upon customer request • TÜV certificate



4 LV DC installation between the connection boxes and the inverter

energy RV-K PRC
1.8 kV DC – 0.6/1 kV AC

HARMOHNY XZ1 Al (S)
1.8 kV DC – 0.6/1 kV AC

Standard cross-sections from 1 x 16 to 1 x 300 mm²

5 LV AC installation to the transformer

energy RV-K PRC
0.6/1 kV AC

HARMOHNY XZ1 Al (S)
0.6/1 kV AC

Standard cross-sections from 1 x 16 to 1 x 300 mm²

6 MV instalations

MV XLPE or EPR insulated cables

Recommended MV cable up to 30 kV • HV cables from 45 kV to 400 kV in underground or overhead lines • Armoured Cable on request

7 Overhead lines

ACSR bare overhead conductors

In accordance with UNE-EN 50182 standards • HV cables from 45 kV to 400 kV • Cross-Sections from 30 mm² to 635 mm²

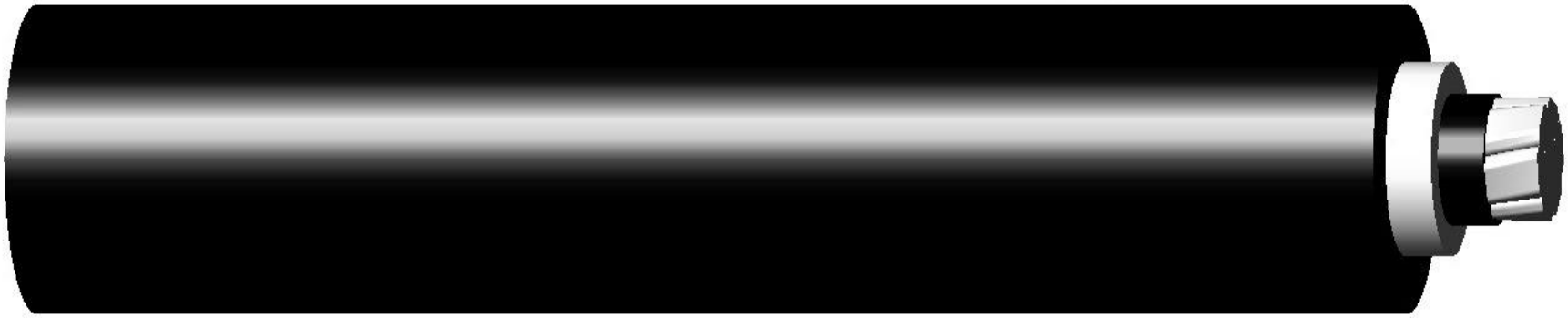
SPACE AERIAL CABLE SYSTEM (SAC)

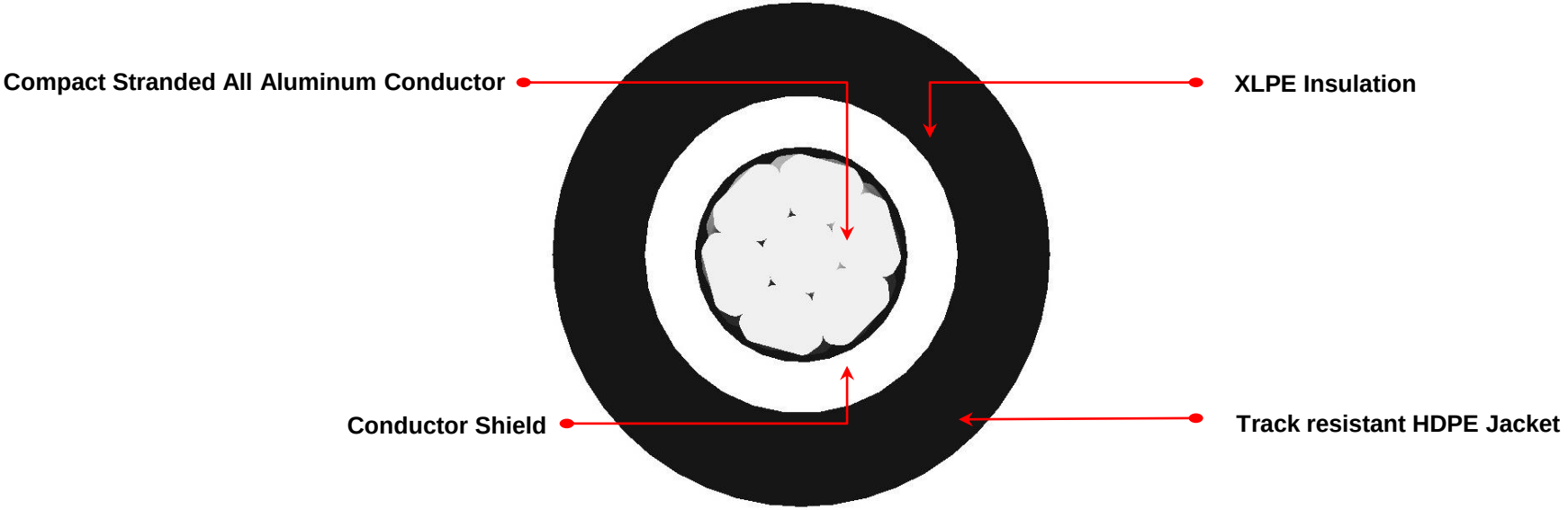
phelps dodge

One time investment. Lifetime protection.

SPACE AERIAL CABLES (SAC)

One time investment. Lifetime protection.





ADVANTAGES OF SPACE AERIAL CABLES

One time investment. Lifetime protection.

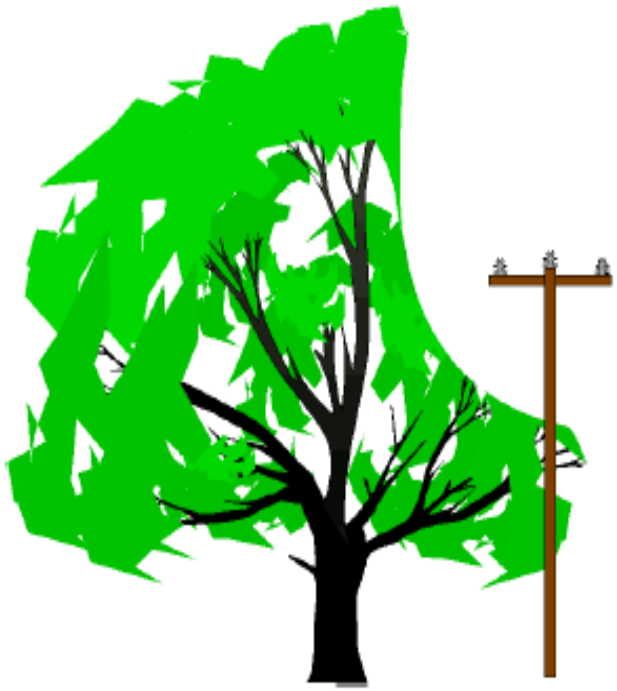
- ✓ **Reduced operating costs**
  - Less intervention on the network and reduced costs of corrective and preventive maintenance

- ✓ **Safety and security**
  - Presence of insulation provides better protection
  - Reduces risk of accidents on operating personnel and nearby people and living animals

- ✓ **Reliability**
  - Longer life span, lower power losses and higher reliability compared to bare conductors

ENVIRONMENTAL IMPACT

phelps dodge
One time investment. Lifetime protection.



Conventional Net

Spacer Cable Sistem

APPLICATIONS OF SPACE AERIAL CABLES

One time investment. Lifetime protection.

- ✓ In areas of difficult access
- ✓ Lines of large spans
- ✓ Areas of high interference of birds
- ✓ In places with high trees
- ✓ In areas of vegetation preserved by law
- ✓ In areas with narrow streets

UL-LISTED LAN CABLES
CATEGORY 5/5E AND CATEGORY 6

phelps dodge

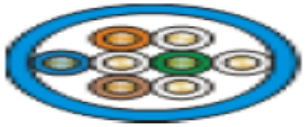
One time investment. Lifetime protection.

CATEGORY 5E LAN CABLES

phelps dodge
One time investment. Lifetime protection.

DATA CABLE (CATEGORY 5E)

CMX/CMR LAN Cable for Horizontal and Vertical Wiring



APPLICATION	
Suitable for both voice and high speed data applications in Local Area Networks - 10 Base-T (IEEE 802.3) - 100 Base-T (IEEE 802.5) - 4/16 Mbps Token Ring (IEEE 802.5) - 52/155 Mbps ATM - 100 VG-AnyLAN - 100 Mbps TP-PMD (ANSI X3T9.5) - 1000 Base-T (Gigabit Ethernet) - Broadband and baseband analogue video - Digital video **Environmental Performance** Installation Temperature -10°C to 40°C Operating Temperature -20°C to 60°C	**COMPLIANCES** - AS/NZS 3080:2003 (Cat 5e) - ISO/IEC 11901 Ed.2 (Cat 5e) - ANSI/TIA 568-C.2 (Cat 5e) - AS/CA S008:2010 - UL Verified (Cat 5e) - UL Listed Type CMX - UL Listed Type CMR **CONDUCTOR** - Plain Annealed Copper Wire (24 AWG) **INSULATION** - High Speed Data Grade Polyolefin - Pair 1 - White/Blue & Blue - Pair 2 - White/Orange & Orange - Pair 3 - White/Green & Green - Pair 4 - White/Brown & Brown **SHEATH** - Flame Retardant PVC - Qualified to be used as riser cable - Cable printed with metre marking

TECHNICAL SPECIFICATIONS

ITEM NUMBER	NOMINAL OVERALL DIA. (mm)	CONDUCTOR		APPROX. MASS (kg/km)	MINIMUM BENDING RADIUS (mm)	STANDARD PACKING REELEX BOX
		Number of Pairs	Number & Diameter of Wires (No./mm)			
24170xxx	4.9	4	1/0.51	29	20	305m

xxx = 021 for Blue
xxx = 096 for Grey
xxx = 199 for White
Other colours available on request

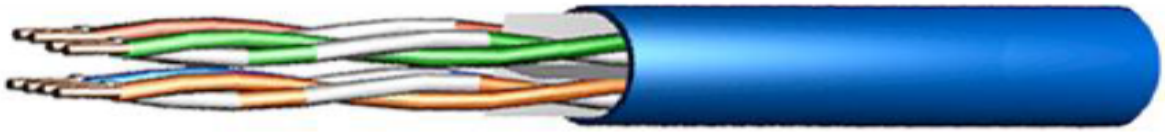
VERIFIED LISTED

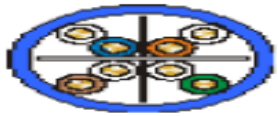
CATEGORY 6E LAN CABLES

phelps dodge
One time investment. Lifetime protection.

DATA CABLE (CATEGORY 6)

CMX/CMR LAN Cable for Horizontal and Vertical Wiring





APPLICATIONS	
Suitable for high speed date applications for Local Area Networks - 10 Base-T (IEEE 802.3) - Broadbank and baseband analog video - 155 Mbps / 1.2 Gbps ATM - IEEE 802.3af DTE Power (PoE) - 100 Base-TX - 1000 Base-T (Gigabit Ethernet) - Digital Video **Environmental Performance** Installation and Operating Temperature -20°C to 60°C	**COMPLIANCES** - AS/NZS 3080:2013 (Cat 6) - ISO/IEC 11801 Ed.2 (Cat 6) - ANSI/TIA 568-C.2 (Cat 6) - AS/CA S008:2010 - UL Listed Type CMX - UL Listed Type CMR - UL Verified Cat 6 **CONSTRUCTION** - Round cable, cross web design **CONDUCTOR** - Plain Annealed Copper Wire (24 AWG) **INSULATION** - High Speed Data Grade Polyolefin - Pair 1 - White/Blue & Blue - Pair 2 - White/Orange & Orange - Pair 3 - White/Green & Green - Pair 4 - White/Brown & Brown '- Core Diameter = 1.00mm Nom **SHEATH** - Flame Retardant PVC - Cable printed with metre marking.

TECHNICAL SPECIFICATIONS

ITEM NUMBER	NOMINAL OVERALL DIA. (mm)	CONDUCTOR		APPROX. MASS (kg/km)	MINIMUM BENDING RADIUS (mm)	STANDARD PACKING REELEX BOX
		Number of Pairs	Number & Diameter of Wires (No./mm)			
24143021	6	4	1/0.53	41	24	305m

VERIFIED LISTED

phelps dodge

VERSA DUCT

BUSWAY

BUSWAY SYSTEM

phelps dodge

One time investment. Lifetime protection.

PD VERSADUCT BUSWAY

phelps dodge
VERSADUCT
BUSWAY

COPPER

Rated Current: 250A up to 5000A

ALUMINUM

Rated Current: 250A up to 4000A

ADVANTAGES OF BUS DUCT SYSTEMS

One time investment. Lifetime protection.

1. **Compact** and **lesser space requirement**
2. **Fast** and **easy to install** compared to
3. **Lower installation costs**
4. **Easy to design** and **to maintain**
5. **Flexible** for future expansion
6. **No power pilferage** – a major power utility concern
7. **More saleable floor area** for property developers

VERSADUCT CERTIFICATIONS

phelps dodge
One time investment. Lifetime protection.

UL LISTED

KEMA


CERTIFICATE

Issued to:
Applicant:
Phelps Dodge Philippines Energy Products Corporation
2nd Floor BCS Prime Building 2297 Pasong Tamo Extension, Makati City, Manila, Philippines

Product(s) : Low-voltage busbar trunking system (copper bar) with/without tap off unit outlet
Trade name(s) : Phelps Dodge
Type(s)/model(s) : PD Versa Duct Copper Busways - 250A/400A/630A/800A/800A(H)/1000A/1250A/1600A/2000A/2500A/3200A/4000A/4000A(H)/5000A/5000A(H)

The product and any acceptable variation thereto is specified in the Annex to this certificate and the documents therein referred to.

DEKRA hereby declares that the above-mentioned product has been certified on the basis of:
– a type test according to the standard EN 61439-6:2012/IEC 61439-6:2012;
– an inspection of the production location according to CENELEC Operational Document CIG 021
– a certification agreement with the number 2163160

DEKRA hereby grants the right to use the KEMA-KEUR certification mark.

The KEMA-KEUR certification mark may be applied to the product as specified in this certificate for the duration of the KEMA-KEUR certification agreement and under the conditions of the KEMA-KEUR certification agreement.

This certificate is issued on: 18 July 2014 and expires upon withdrawal of one of the above mentioned standards.

Certificate number: 3305984.01

DEKRA Certification B.V.

drs. G.J. Zoetbrood
Managing Director

F.S. Strikwerda
Certification Manager

© Integral publication of this certificate is allowed

ACCREDITED BY THE DUTCH ACCREDITATION COUNCIL

KEMA KEUR

DEKRA Certification B.V. Meander 1051, 6825 MJ Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
T +31 88 96 83000 F +31 88 96 83100 www.dekra-certification.com Registered Arnhem 09085396


CERTIFICATE

Issued to:
Applicant:
Phelps Dodge Philippines Energy Products Corporation
2nd Floor BCS Prime Building 2297 Pasong Tamo Extension, Makati City, Manila, Philippines

Product(s) : Low-voltage busbar trunking system (aluminum bar) with/without tap off unit outlet
Trade name(s) : Phelps Dodge
Type(s)/model(s) : PD Versa Duct Aluminum Busways - 250A/400A/630A/800A/1000A/1250A/1600A/2000A/2500A/3200A/4000A

The product and any acceptable variation thereto is specified in the Annex to this certificate and the documents therein referred to.

DEKRA hereby declares that the above-mentioned product has been certified on the basis of:
– a type test according to the standard EN 61439-6:2012/IEC 61439-6:2012;
– an inspection of the production location according to CENELEC Operational Document CIG 021
– a certification agreement with the number 2163160

DEKRA hereby grants the right to use the KEMA-KEUR certification mark.

The KEMA-KEUR certification mark may be applied to the product as specified in this certificate for the duration of the KEMA-KEUR certification agreement and under the conditions of the KEMA-KEUR certification agreement.

This certificate is issued on: 18 July 2014 and expires upon withdrawal of one of the above mentioned standards.

Certificate number: 3305984.02

DEKRA Certification B.V.

drs. G.J. Zoetbrood
Managing Director

F.S. Strikwerda
Certification Manager

© Integral publication of this certificate is allowed

ACCREDITED BY THE DUTCH ACCREDITATION COUNCIL

KEMA KEUR

DEKRA Certification B.V. Meander 1051, 6825 MJ Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
T +31 88 96 83000 F +31 88 96 83100 www.dekra-certification.com Registered Arnhem 09085396

- **UL** and **KEMA** certified for both copper and aluminum bus duct systems

FIRE-RATED CABLES

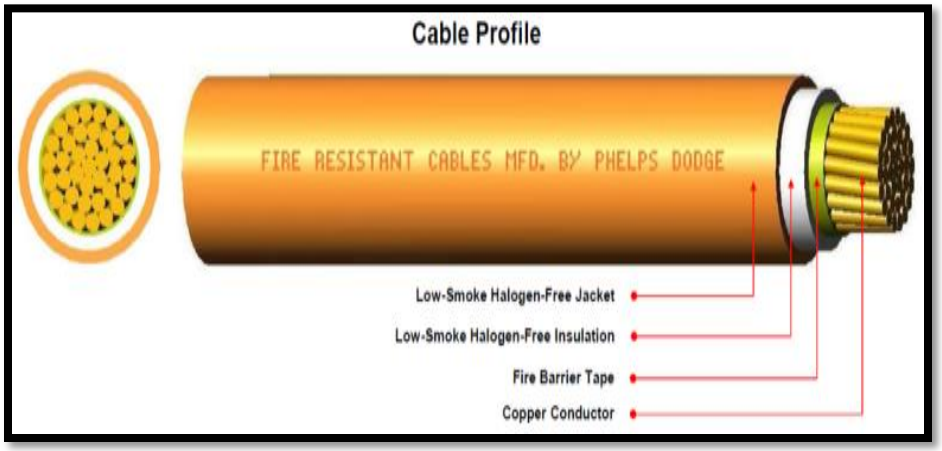
phelps dodge

One time investment. Lifetime protection.

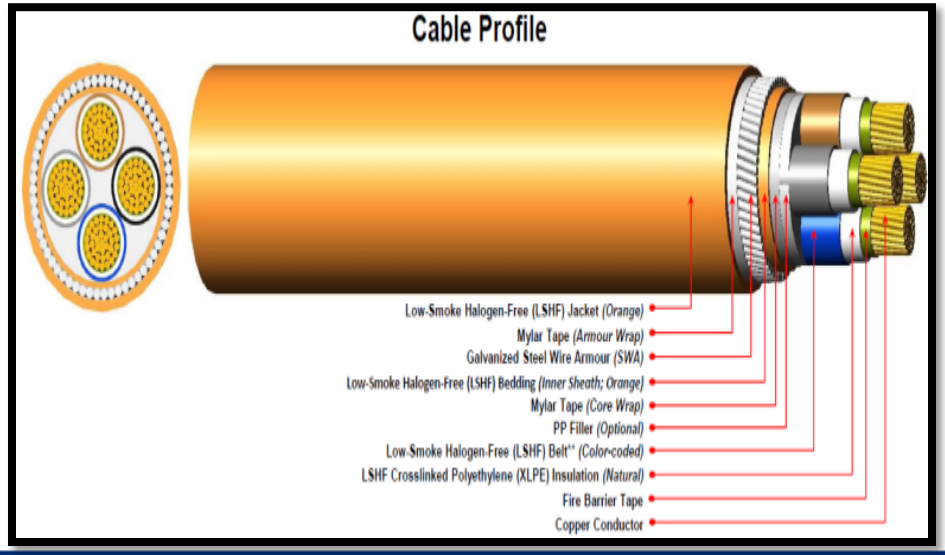
FIRE-RATED CABLES

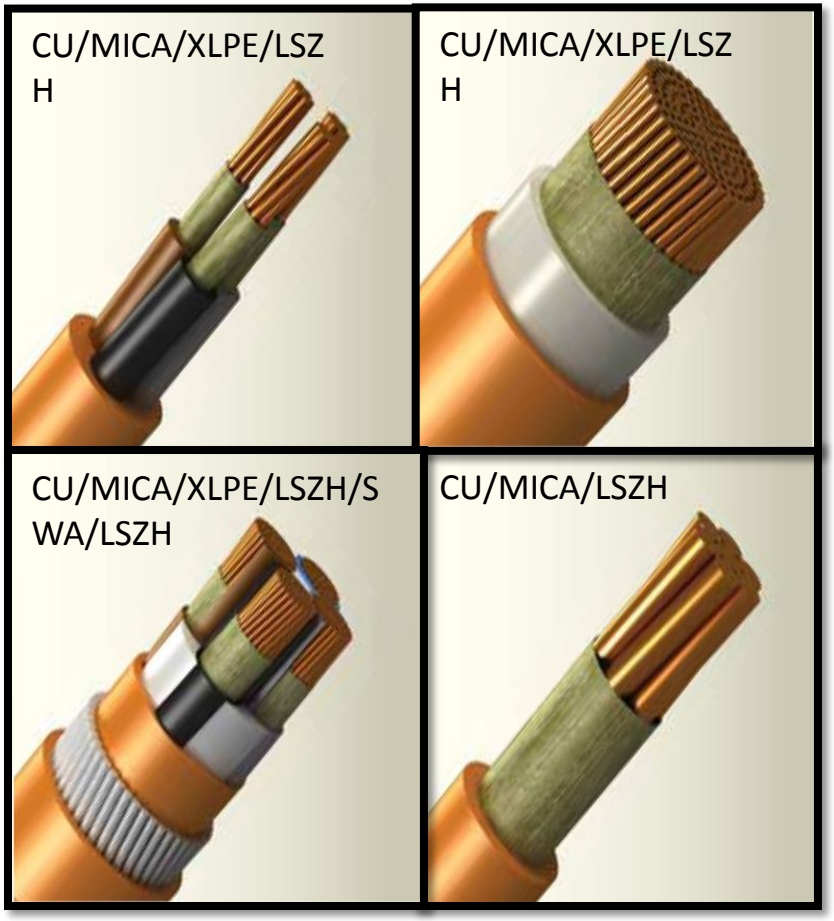
One time investment. Lifetime protection.

Single Core



Multicore





phelps dodge
One time investment. Lifetime protection.

PROJECT REFERENCES

The Philippine Arena

Solaire Resort and Casino

PROJECT REFERENCES

- Waltermart Tanauan
- Abenson Inc.
- Posh Properties Development Corporation
- Echo Electrical Supply Corporation
- Vicsal Development Corporation
- Willimson Inc.
- Willin Sales Inc.

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

PSB Singapore

TEST CERTIFICATE

This Certificate is issued to

Phelps Dodge Energy Products Corporation
Luisita Industrial Park,
San Miguel,
Tarlac City,
Philippines 2301

FOR

Product:	Fire Resistant Cable
Brand/Model:	PHELPS DODGE
Detail:	Size: 1C x 50 mm²; Voltage: 600/1000V; Conductor: Circular stranded plain annealed copper wires; Fire resistant layer: Mica tape; Insulation: XLPE (White); Sheath: LSHF (Black)
Specification:	BS 6387 : 1994* *BS 6387 : 1994 does not cover cables having one insulated conductor but no other metallic element. Tests were conducted by adopting the test methods of BS 6387 : 1994 as requested by the client. BS 6387: 1994 is applicable to cables rated at voltages not exceeding 450/750V. The voltage applied to the tests was based on 600/1000V as requested by the client.
Test Report:	719187801-EEC10

Summary

A sample of the product has been tested and is found to meet with the requirements of the above standards.

Vice President (Electrical & Electronics)
TÜV SÜD PSB Pte Ltd

Certificate No:	Date of Original Issue:	Date of Last Revision:	Date of Expiry:
02419	07/12/2010	-	06/12/2012

This Certificate is part of a full report and should be read in conjunction with it. This Certificate remains the property of TÜV SÜD PSB Pte Ltd and shall be returned upon request. The use of this Certificate is subjected to the terms and conditions of the Test Certification Scheme.
Note: This Certificate is not a Certificate of Conformity.

TÜV SÜD PSB Pte Ltd • 1 Science Park Drive , Singapore 118221

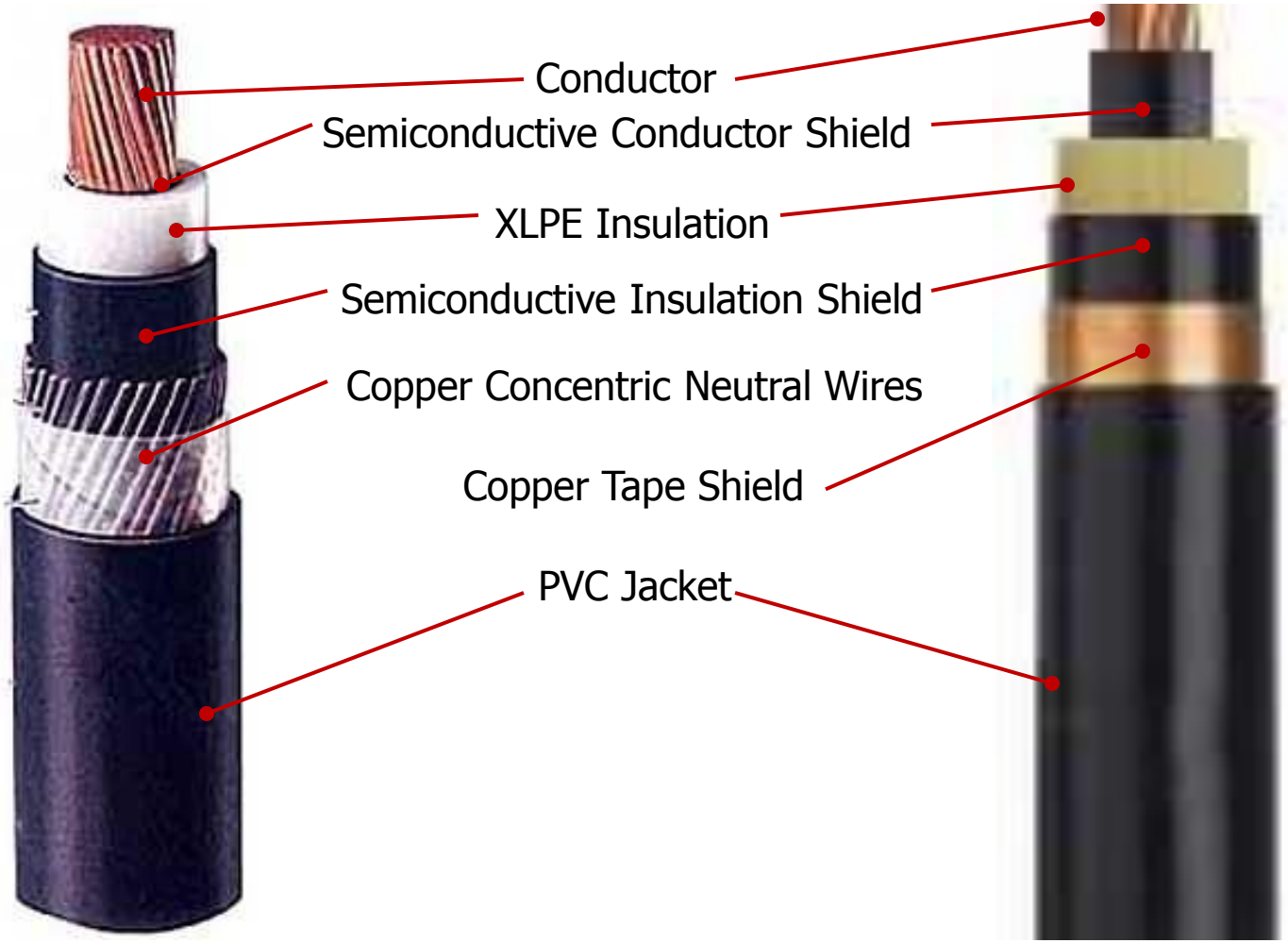
PDP's Certification for Fire Rated Cables

MEDIUM VOLTAGE POWER CABLE UP TO 35KV

phelps dodge

One time investment. Lifetime protection.

MEDIUM VOLTAGE CABLES



Concentric Neutral Cable

Tape Shielded Cable

phelps dodge International Corp
a General Cable company

ENGAGE
TOTAL ENGINEERING ADVANTAGE

PD ENGAGE (TOTAL ENGINEERING ADVANTAGE)

One time investment. Lifetime protection.

THANK YOU

phelps dodge

One time investment. Lifetime protection.