

Exploring Wire and Cable Used in Data Centres

Prepared by:
Wissam Geahchan, P. Eng.
Applications Engineer
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HOUSEKEEPING

- Questions can be asked at any time using the chat function on the webinar screen
- Any unanswered questions will be followed up through email
- This presentation, a recording of the webinar and a brief survey will be emailed to all registrants

ABOUT MYSELF



Wissam Geahchan, P. Eng
Applications Engineer

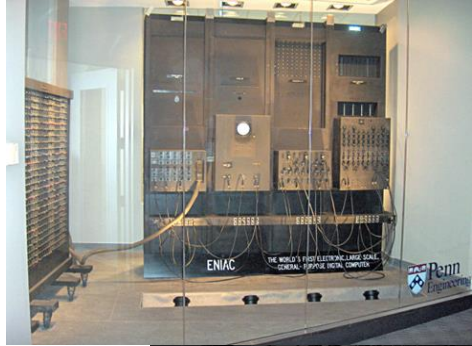
- Licensed Professional Engineer (P. Eng.) in Ontario
- Experience applying the CE Code in a variety of applications
- Active member on several industry standards committees at CSA, UL, and ICEA.
- Licensed soccer coach

Agenda

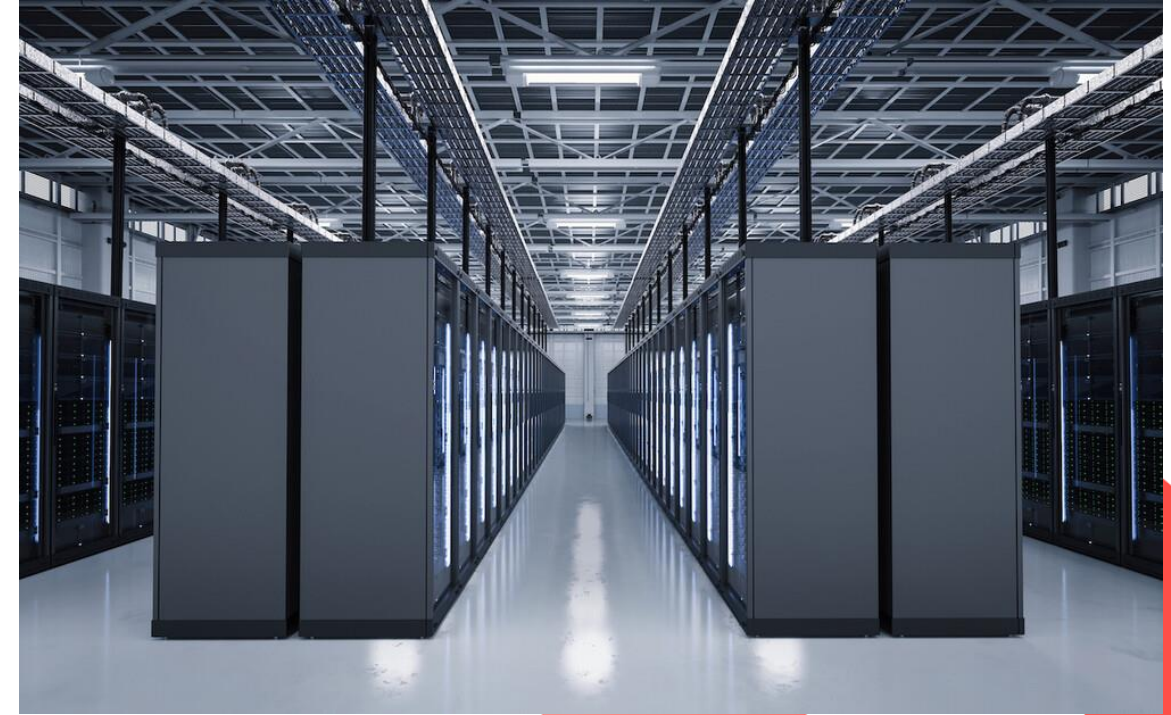
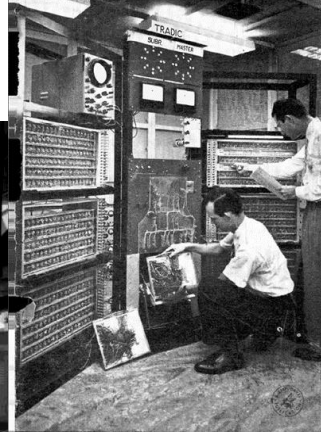
- 1 | Brief History
- 2 | Introduction
- 3 | Relevant Standards
- 4 | Data Centre Design Considerations
- 5 | Centre Data Centre Power Distribution
- 6 | Rooms/Areas in a Data Centre
- 7 | Nexans Data Centre Offer in a Nutshell
- 8 | Wiring Methods and Requirements
- 9 | North American Wire Product and Rating Comparisons

1. BRIEF HISTORY

ENIAC



TRADIC



Then (1940 – 1990)

Now (1990 – Present)

2. INTRODUCTION

A data centre is a specialized facility designed to house clients' server equipment, ensuring reliable and uninterrupted operations.

A data centre is equipped with a fault-tolerant system that includes:

- Continuous and guaranteed power supply systems
- Dispatching and monitoring systems
- A structured cabling network



3. RELEVANT STANDARDS THAT GOVERN THE DESIGN OF DATA CENTRES

NATIONAL
ELECTRICAL AND
BUILDING CODES

Canadian Electrical Code, Part
1 (CE Code)

National Building Code of
Canada (NBC)

National Electric Code (NEC)



ANSI and ASHRAE

ANSI/TIA-942 Data Center
Infrastructure Standard

ANSI/TIA-569-B Commercial
Building Standard for
Telecommunications Pathways
and Spaces

ANSI-J-STD-607-A Commercial
Grounding and Bonding
Requirements for
Telecommunications

ASHRAE 90.4 Energy
Standard for Data Centers

ASSOCIATIONS

The Uptime Institute

AFCOM

LEED

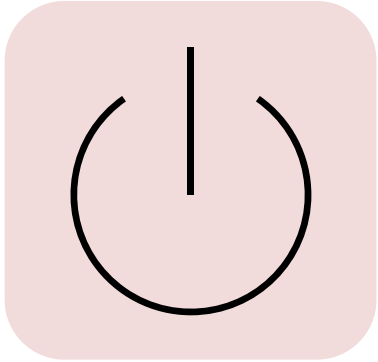


uptime
INSTITUTE



Nexans

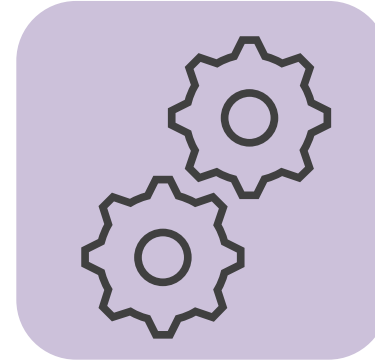
4. DATA CENTRE DESIGN CONSIDERATIONS



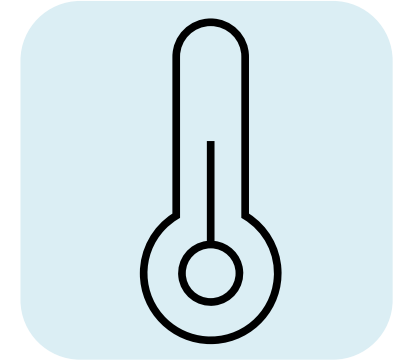
POWER
REQUIREMENTS



RELIABILITY



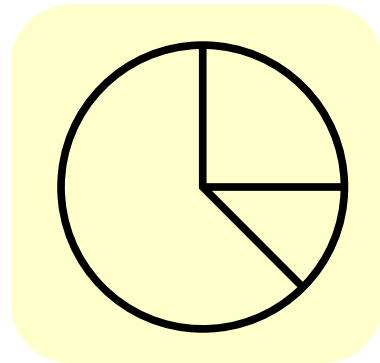
EFFICIENCY



COOLING



ENGINEERING



SPACE
ALLOCATION

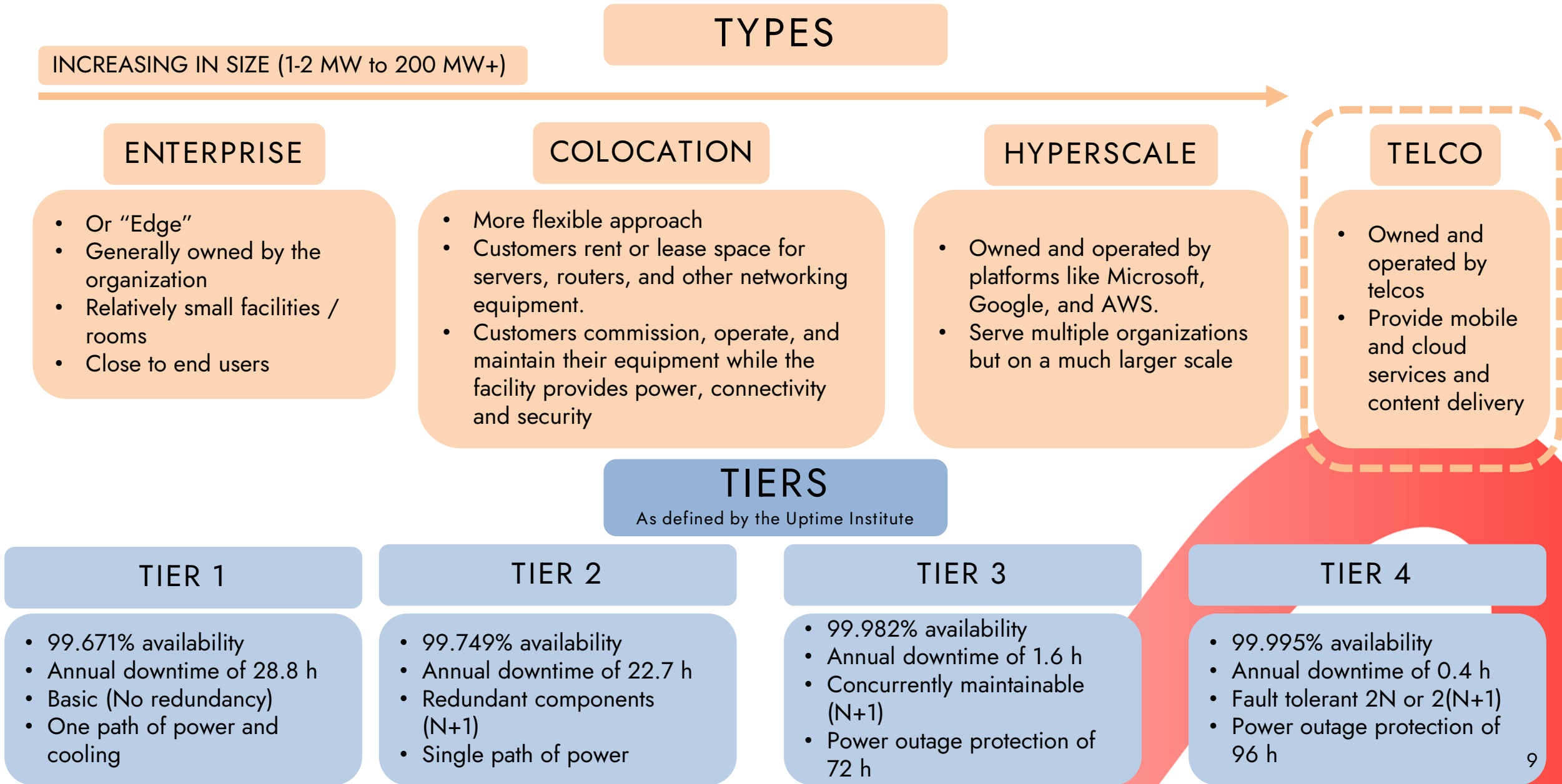


CABLE
MANAGEMENT



ENVIRONMENT

4. DATA CENTRE DESIGN CONSIDERATIONS



4. DATA CENTRE DESIGN CONSIDERATIONS

POWER REQUIREMENTS

SMALL

MEDIUM

LARGE

Building Size (sqft)

5k – 20k

20k – 100k

100k – 1M

Server count

500 – 2,000

2,000 – 10,000

10,000 – 100,000

Power Capacity (MW)

1 – 2

2 – 20

20 – 200+

Design/Efficiency

Basic

Robust power management, partial efficiency

High efficiency, renewable energy use

4. DATA CENTRE DESIGN CONSIDERATIONS

COOLING

Cooling equipment may typically include the following:



Chillers



Cooling towers



Condensers



CRAC units



Liquid cooling pipes / pumps



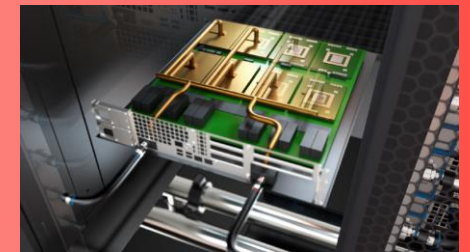
Fans



Blanking panels

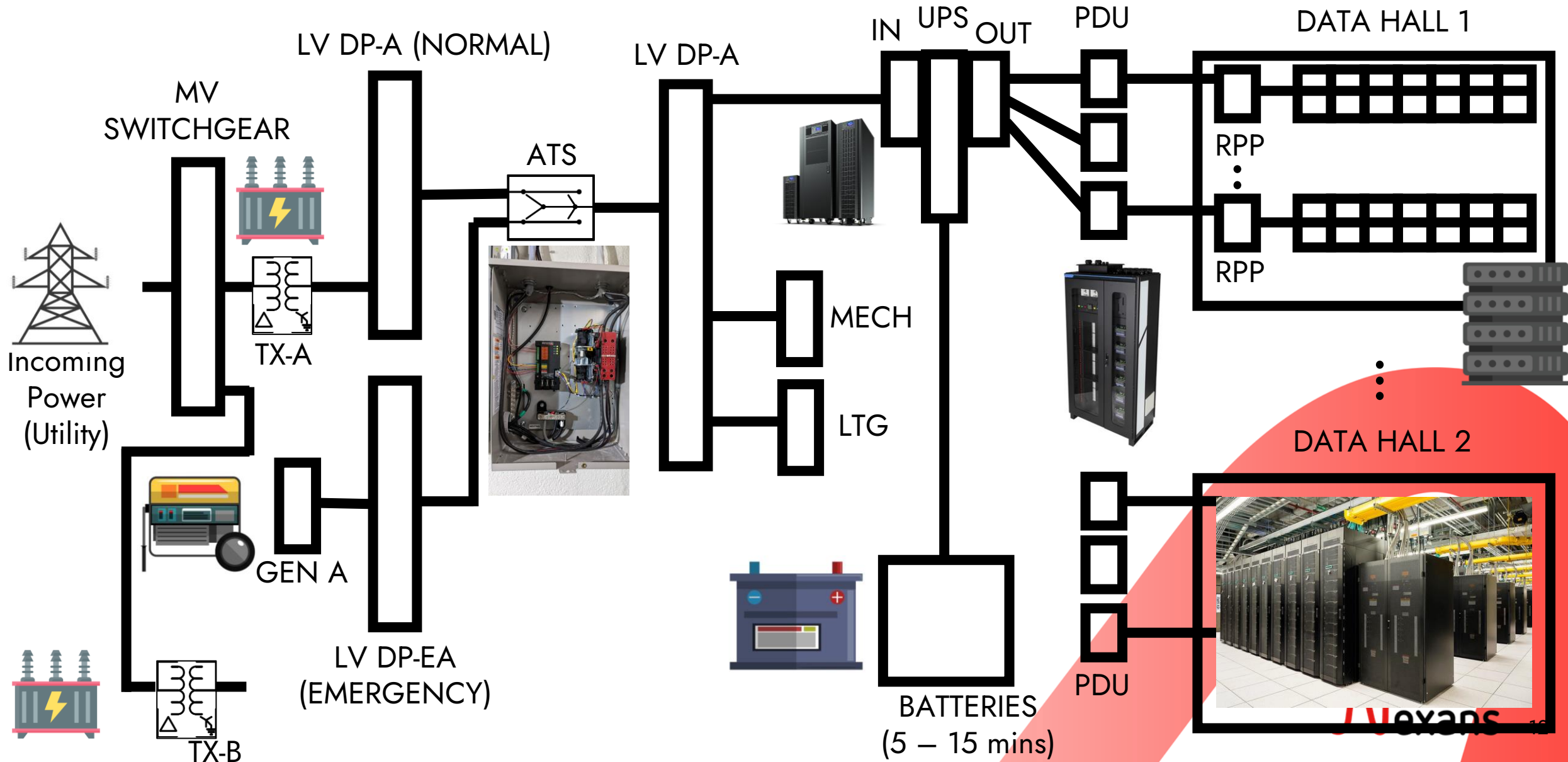


Ceiling-mounted variable capacity cooling systems



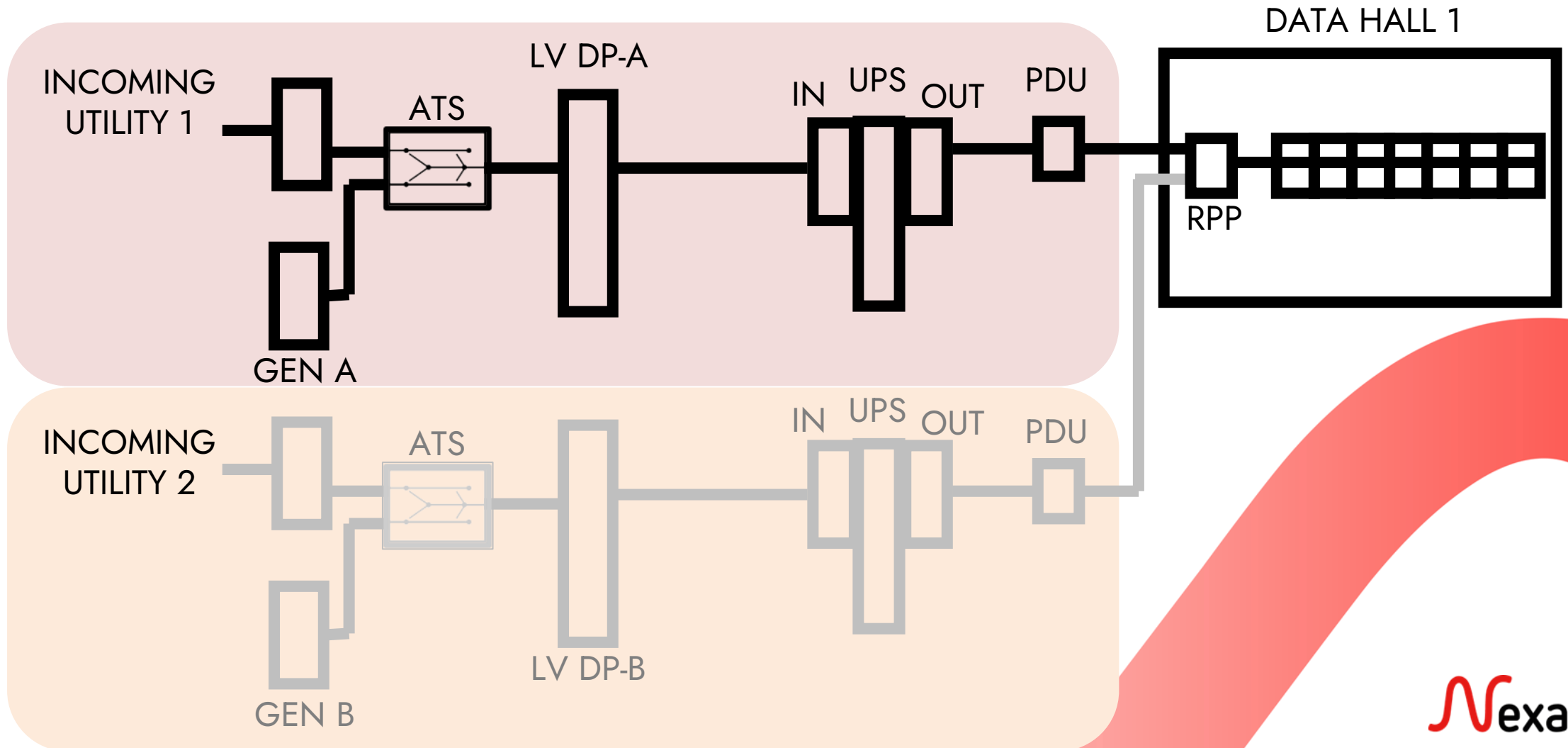
Direct-to-chip (DTC) liquid cooling

5. DATA CENTRE POWER DISTRIBUTION



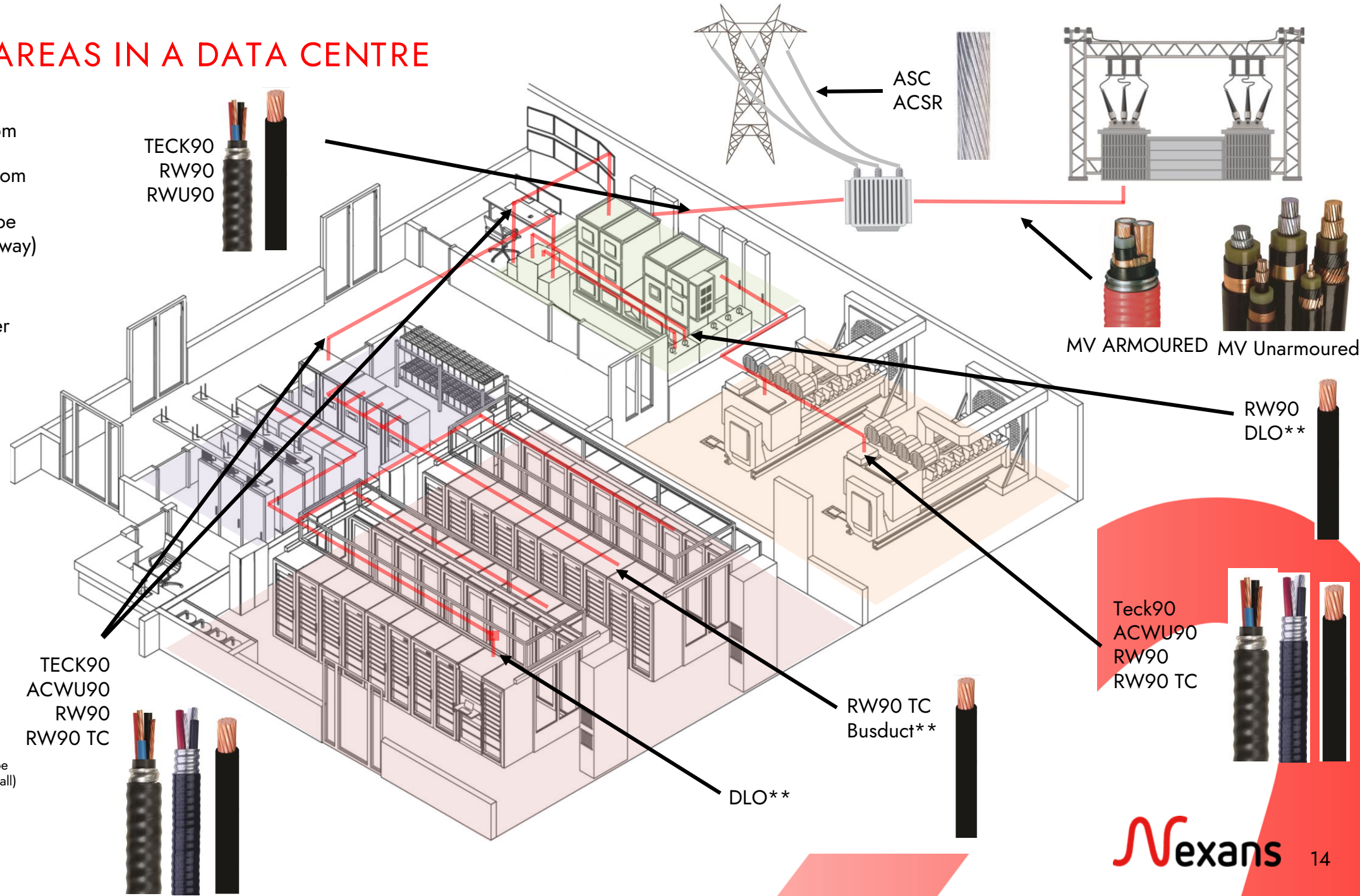
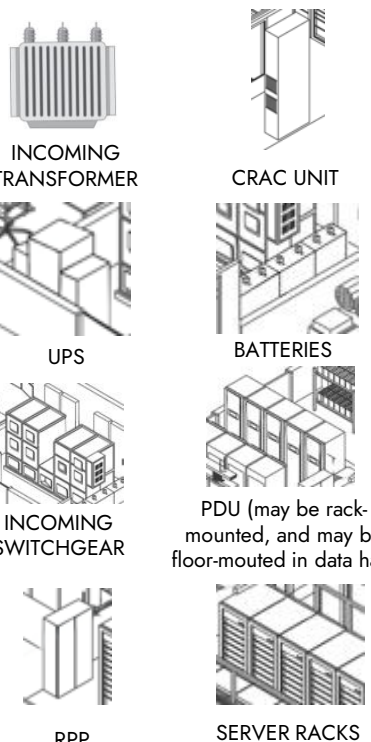
5. DATA CENTRE POWER DISTRIBUTION

SIMPLIFIED SLD OF A REDUNDANT POWER SYSTEM



6. ROOMS/AREAS IN A DATA CENTRE

- Electrical Room
- Generator Room
- Gallery (can be elevated walkway)
- Data Hall
- ** No cable offer



TECK90
RW90
RWU90

ASC
ACSR

MV ARMoured MV Unarmoured

RW90
DLO**

Teck90
ACWU90
RW90
RW90 TC

RW90 TC
Busduct**

DLO**

TECK90
ACWU90
RW90
RW90 TC

7. NEXANS DATA CENTRE OFFER IN A NUTSHELL

Cable
Offering



Supply Chain
Services



Sustainability



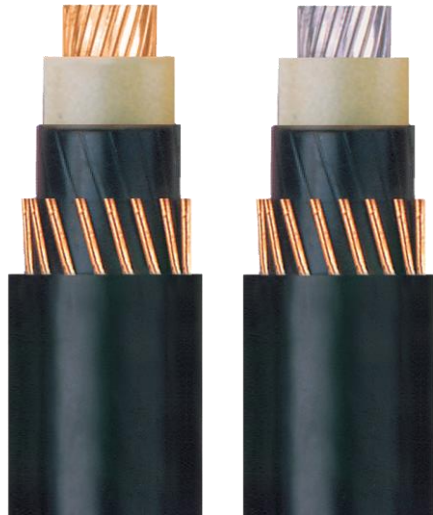
Engineering
Services



7. NEXANS DATA CENTRE OFFER

INCOMING SERVICE

Medium voltage power supply from a supply authority to a consumer's service



MV CONCENTRIC NEUTRAL
(5-46 kV)



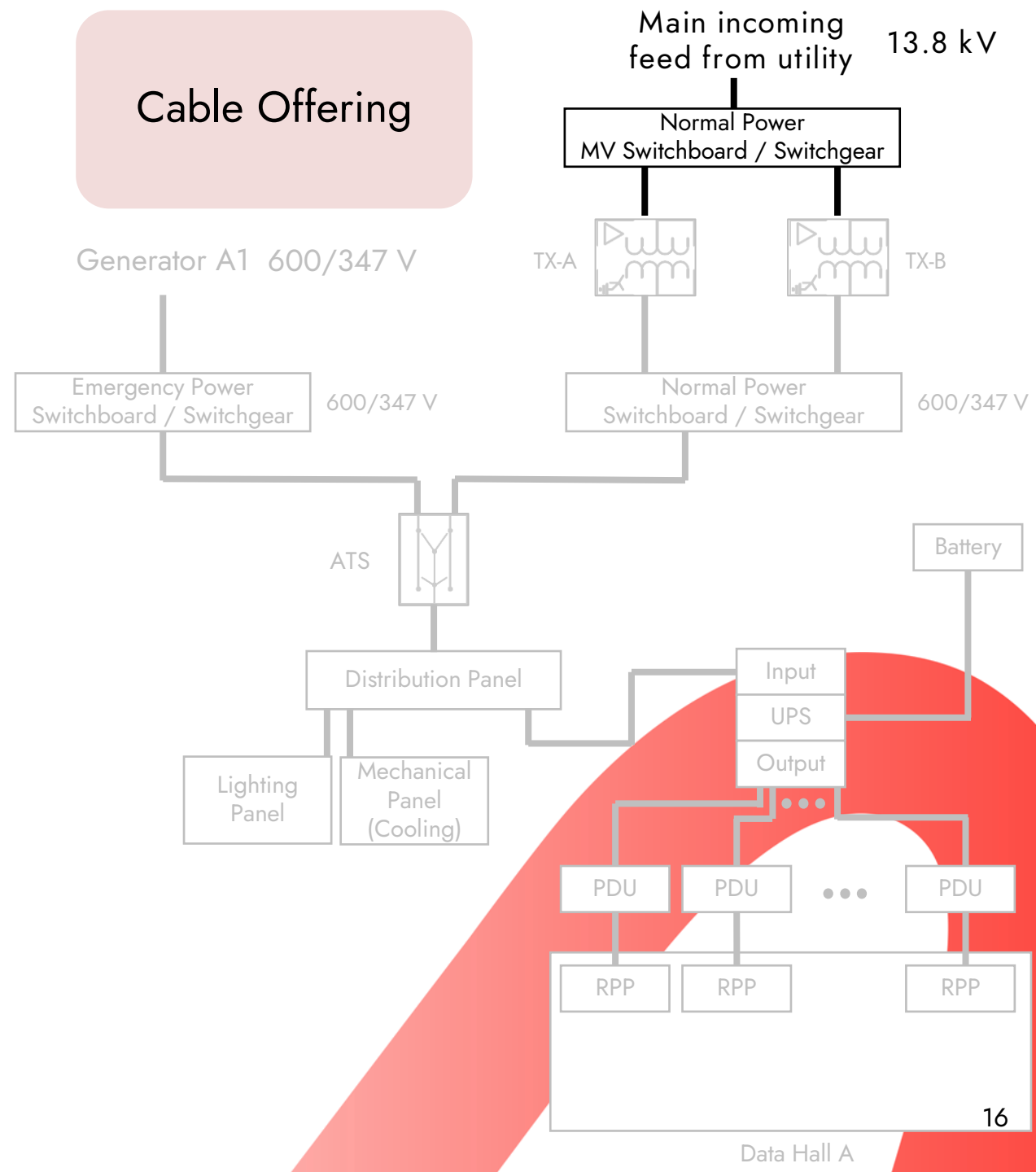
MV ARMOURED
(5-15 kV)

Method of installation

Exposed
Concealed
Raceway
Direct burial

Exposed
Concealed
Raceway
Cable tray
Direct burial

Cable Offering



7. NEXANS DATA CENTRE OFFER

ARMoured POWER CABLES

Armoured power cables for use on cable trays, unistrut, or strapped to walls.



TECK90
(1 kV)

Exposed
Concealed
Raceway
Direct burial
Cable tray

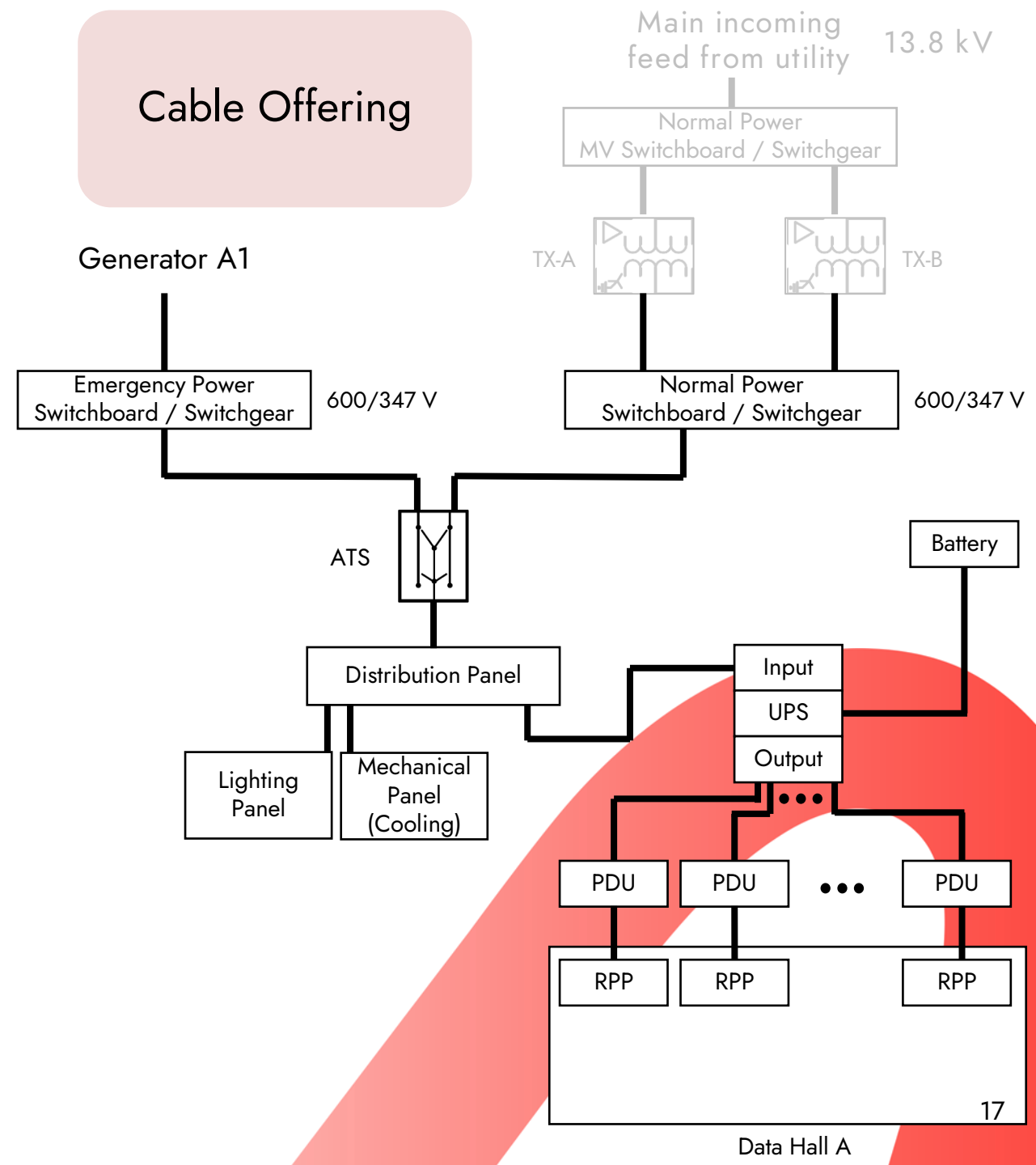


ACWU90
(600V)

Exposed
Concealed
Raceway
Direct burial
Cable tray

Method of installation

Cable Offering



7. NEXANS DATA CENTRE OFFER

UN-ARMOURED POWER CABLES

Armoured power cables for use on cable trays and in conduit.



RW90

RW90 TC

RWU90

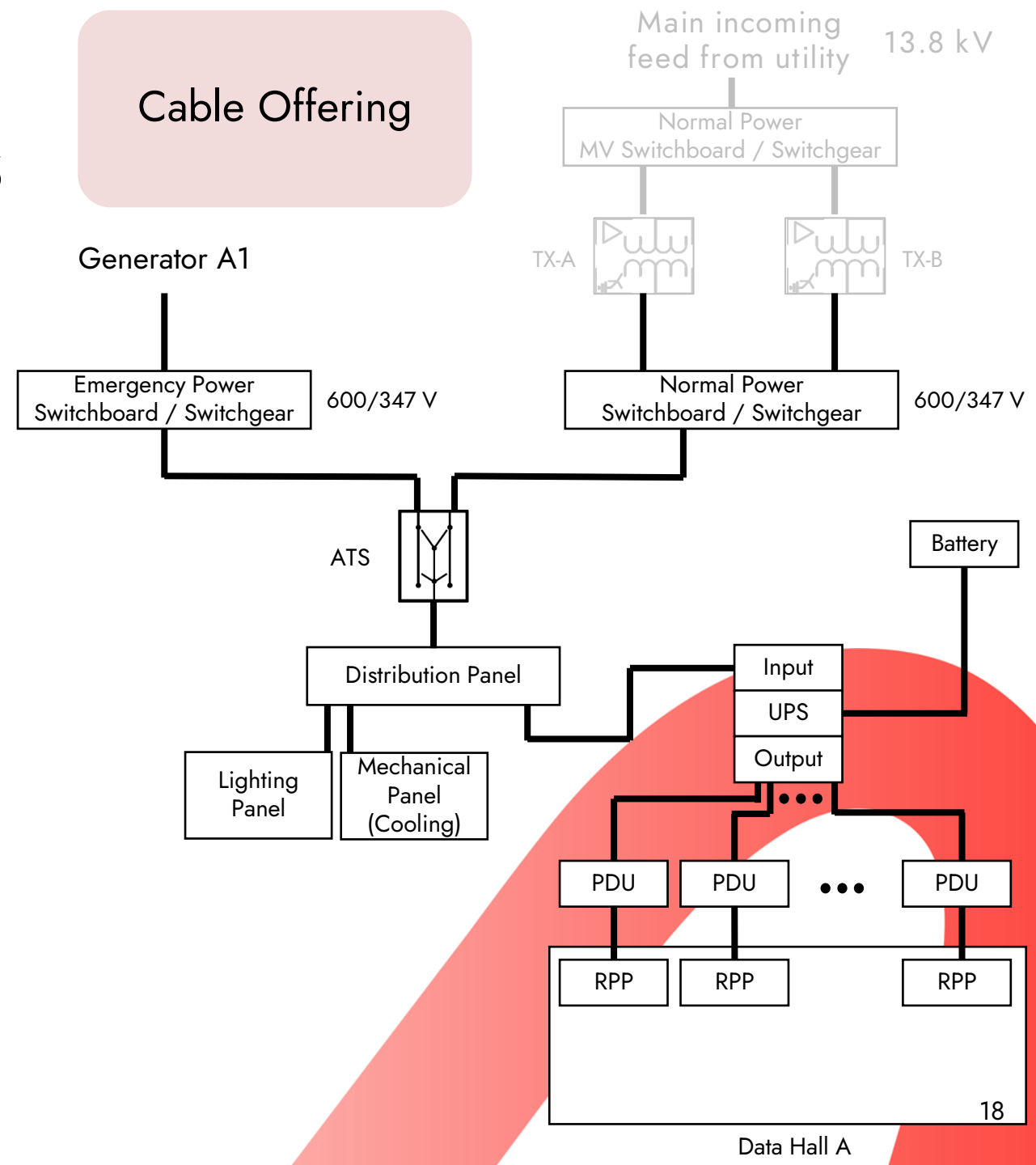
Raceway

Cable Tray (with TC)

Direct Burial (RWU90)

Method of installation

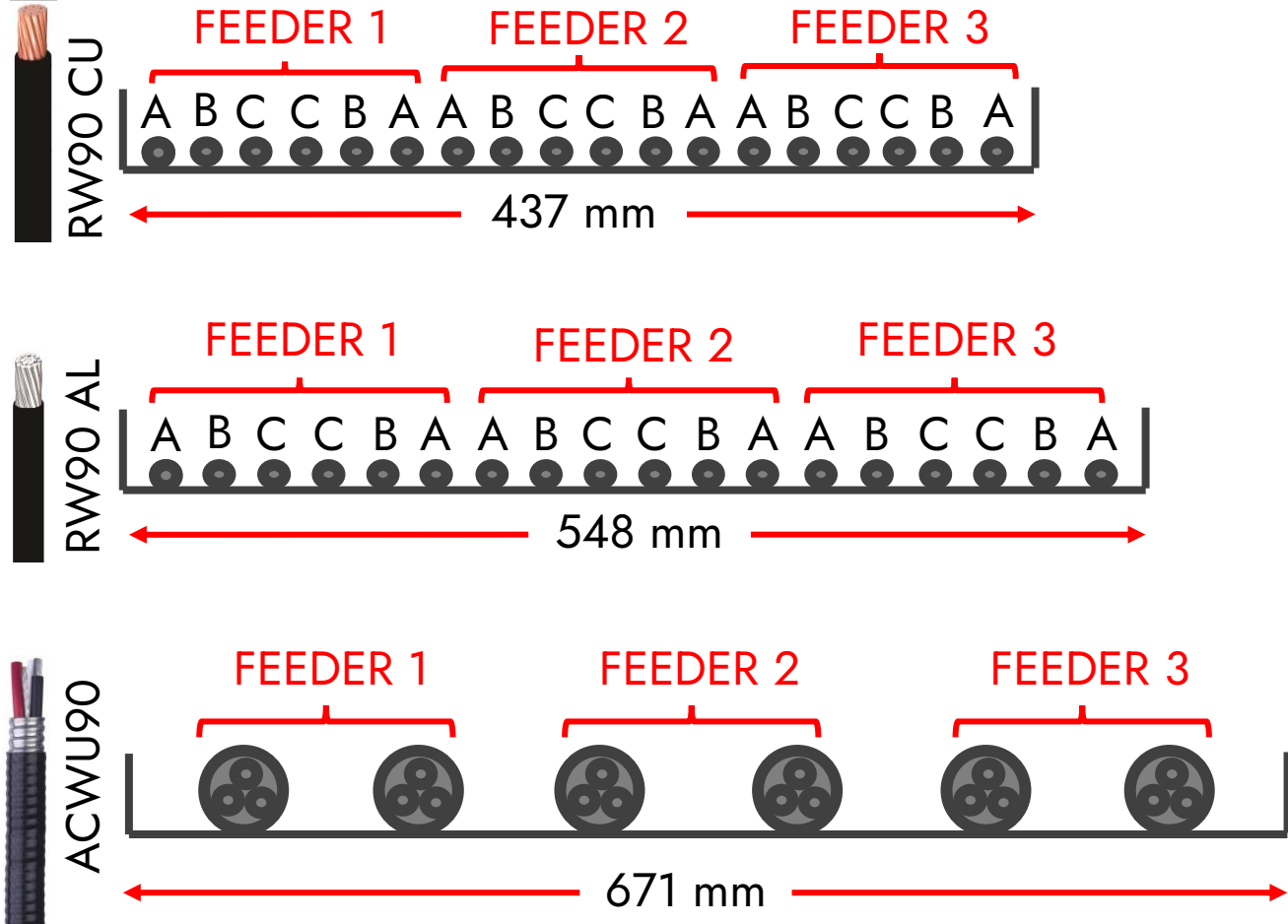
Cable Offering



7. NEXANS DATA CENTRE OFFER

The significance of cable selection *

Context: Feeding three (3) 500 A racks. 2 runs per feeder.
 Not accounting for voltage drop or in-rush current.



Size (AWG/kmcil)	Ampacity** (Max Available)	Total Cable Weight (kg/km)	Relative Total Cost (Total)	Losses (kW)	CO ₂ (kgCO ₂ /year/km)
1/0	1560 A	9576	1	815	171,400
4/0	1680 A	6480	0.45	773	162,500
350	1500 A	17750	1.06	374	80,000

* This slide should not be used as a recommendation, but instead as a reference to the different criteria that may be considered when selecting cables.

** Ampacity derived from the tables in the CE Code with conductor/cable spacing maintained at least 1 conductor/cable diameter apart

7. NEXANS DATA CENTRE OFFER

SUPPLY CHAIN SERVICES

Secure Supply & Control Risks

- Supply chain efficiency with:
 - prioritized plant capacity allocation to guarantee shortest lead time;
 - dedicated project monitoring to secure on-time-delivery;
 - adjustable Minimum Order Quantity and on-site delivery; and
 - customized cable length including cuts and reel optimization.
- **Metal hedging** to mitigate risk of price volatility to ensure on-budget projects.
- **Longer lifespan** with high standard CSA products produced with best-in-class compounds.
- **Local dedicated teams & plants** with high reactivity at every stage of the project for trouble free project execution.

Supply Chain
Services



7. NEXANS DATA CENTRE OFFER

SUSTAINABILITY

Sustainability



Reduce Environmental Impact

- **Full transparency to measure products Environmental impact**
 - +90% Nexans products covered by certified Environmental Product Declarations (EPDs)
 - Access to EPD data directly accessible through Nexans website
 - CO2 quotation per project available on demand
- **Low carbon products with CO2 footprint reduced up to 40%**
 - Minimum 14% recycled copper in Nexans products
 - 100% “Low carbon” Aluminum in conductor
 - Responsibly produced copper guaranteed through the Copper Mark certification
- **Benefits of Made in Canada production**
 - Reduced GHG emission in Nexans plants with -46% scope 1&2 emission between 2019 and 2024
 - Reduced transport GHG emission with local production and optimized Road/Rail routes

7. NEXANS DATA CENTRE OFFER ENGINEERING SERVICES

Engineering
Services



Cable Selection, Installation, Calculations and Sizing

- **Cable selection and installation support** to better understand what cables can be used and how they can be installed.
- **Cable sizing and thermal studies** to optimize your installations.
- **Pulling tension calculations** to plan pulls with safety and efficiency in mind.
- **Codes and standards interpretation and understanding** for safe and compliant electrical designs in North America.
- **Cable field testing support** for acceptance and maintenance testing.

Common Wiring Methods in Data Centres

1 Cable Tray

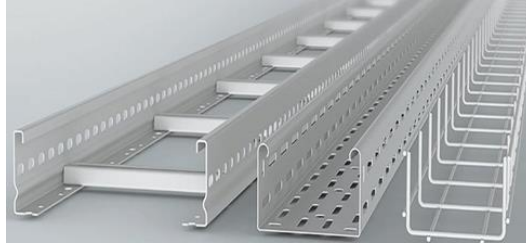
Raceway

- 2
- a. Conduit
 - b. Underfloor
 - c. Busway

3 Cablebus

8. WIRING METHODS AND REQUIREMENTS

Cable Tray



A support system that enables easy installation or removal of insulated cables without damage.

Ladder-type



Non-ventilated



Ventilated



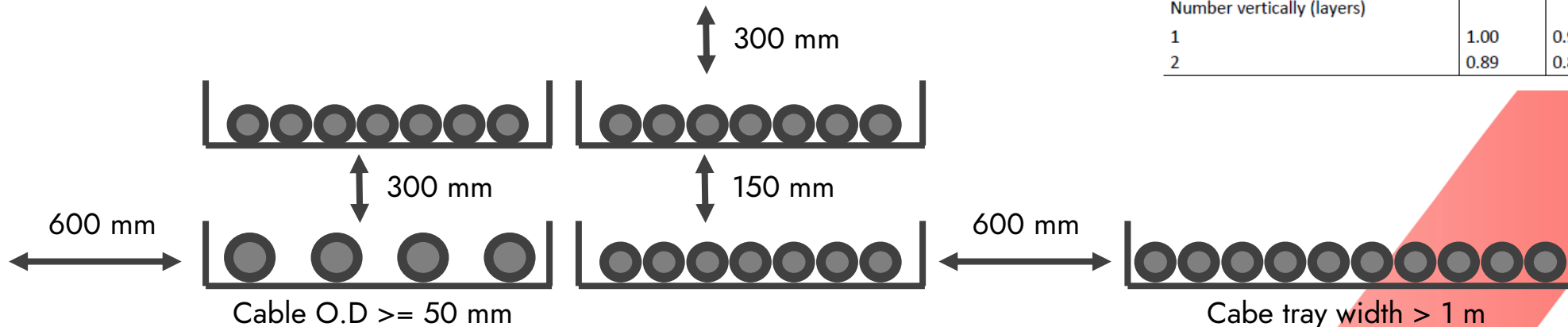
Wire-mesh



CE Code, Table 5D

Table 5D
Current rating correction factors where spacings are maintained
(in ventilated and ladder-type cable trays)
(See Rule 4-004 and Table 12E.)

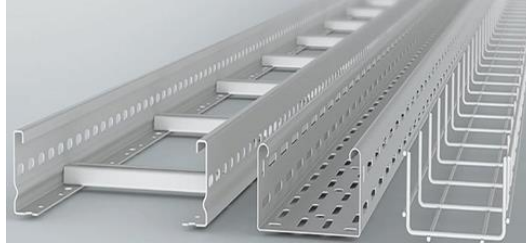
Number of insulated conductors or cables horizontally	1	2	3	4	5	6
Number vertically (layers)						
1	1.00	0.93	0.87	0.84	0.83	0.82
2	0.89	0.83	0.79	0.76	0.75	0.74



8. WIRING METHODS AND REQUIREMENTS

1

Cable Tray



CABLES FOR USE IN CABLE TRAYS

Armoured Power Cables (LV and MV)



ACWU90
(600V)



TECK90
(1 kV)



MEDIUM VOLTAGE
(5-15 kV)

Unarmoured Power Cables marked TC (LV and MV)



RW90 TC



MEDIUM VOLTAGE TC

8. WIRING METHODS AND REQUIREMENTS

2

Any channel designed for holding wires, cables, or busbars

Raceway



Common Types

Example

Benefits

Considerations

Conduit



Enhanced protection for cables
Protects against water and dust
Cable accessibility

Space availability
Installation time

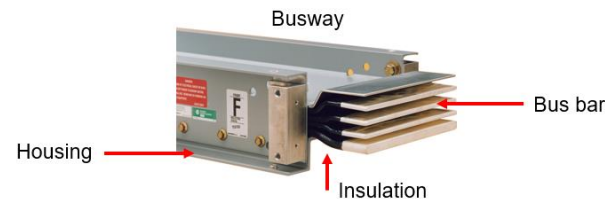
Underfloor



Keeps cables hidden
Optimizes space utilization
Enhanced cooling efficiency

Installation method
Modifications
Cost

Busway



Enhanced Efficiency
Improved Accessibility
Cost-Effective

Weatherproofing

8. WIRING METHODS AND REQUIREMENTS

CONDUIT

A tube used to protect and route electrical wiring in a building or structure.



Raceway

Rigid Metallic



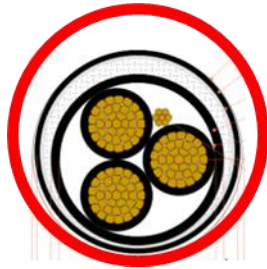
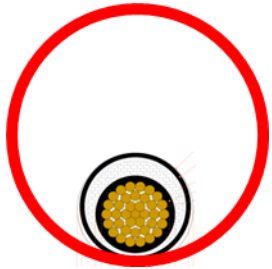
Rigid Non-Metallic



Flex Metallic



Flex Non-Metallic



CE Code

Table 8

Maximum allowable per cent conduit and tubing fill
(See Rules 12-902, 12-910, and 38-032.)

	Maximum conduit and tubing fill, %				
	Number of insulated conductors or multi-conductor cables				
	1	2	3	4	Over 4
Insulated conductors or multi-conductor cables (not lead-sheathed)	53	31	40	40	40
Lead-sheathed single conductor cables or multi-conductor cables	55	30	40	38	35

CABLES FOR USE IN CONDUIT



RW90
RWU90



T90 / TWN75

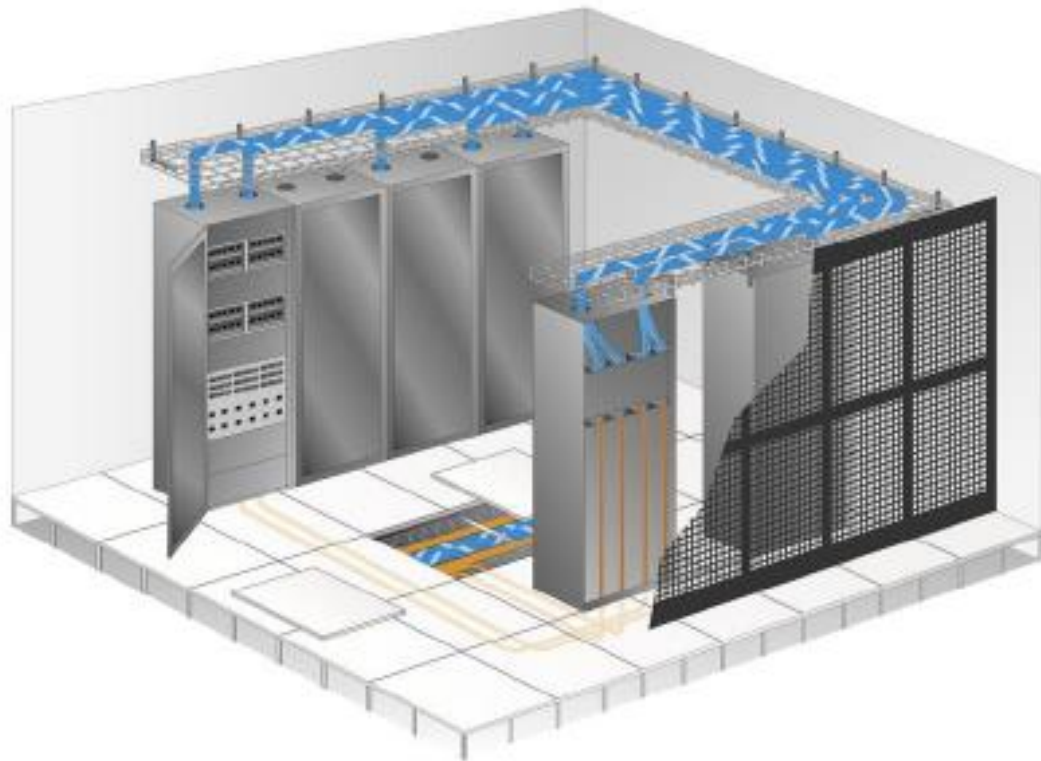
8. WIRING METHODS AND REQUIREMENTS

2

UNDERFLOOR RACEWAY

A raceway suitable for use in the floor.

Raceway



CABLES FOR USE IN UNDERFLOOR RACEWAYS



RW90
RW90 TC
RWU90



T90 / TWN75



ACWU90
(600V)

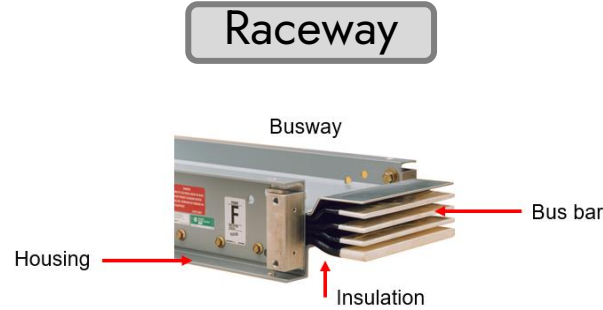


TECK90
(1 kV)

8. WIRING METHODS AND REQUIREMENTS

2

BUSWAY



A raceway consisting of metal troughing (including elbows, tees, and crosses, in addition to straight runs) containing conductors that are supported on insulators.



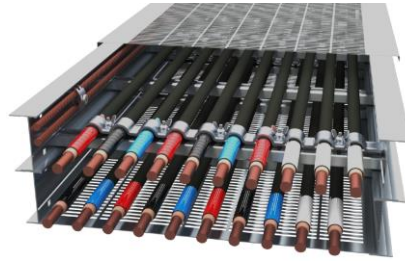
CABLES FOR USE IN BUSWAYS

No cables used in busways. Instead, it consists of a bus bar.

8. WIRING METHODS AND REQUIREMENTS

3

Cablebus



Cablebus - an assembly of insulated conductors or cables, or both, with fittings and conductor terminations in a completely enclosed, ventilated, or non-ventilated protective metal housing

Benefits –

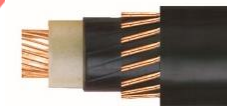
1. Free air cable rating
2. High Current Loads
3. Reduced Power Losses
4. Cost Efficient
5. EMF Suppression
6. Simplified Installation
7. Expandability
8. Safe and Reliable



CABLES FOR USE
IN CABLEBUS



RW90 / RW90 TC
RWU90



MEDIUM VOLTAGE
(C68.5 OR C68.10)

9. NORTH AMERICAN WIRING PRODUCT AND RATING COMPARISONS

CSA vs UL



T90 vs THHN



RW90 vs XHHW-2



CSA TC vs UL TC



FT4 vs IEEE 1202



AC vs MC



9. NORTH AMERICAN WIRING PRODUCT AND RATING COMPARISONS

T90 vs THHN



	T90	THHN
STANDARD	CSA C22.2 NO. 75	UL 83
CONDUCTOR	CU or AL	CU or AL
INSULATION	<u>Thermoplastic</u> (Typically PVC)	<u>Thermoplastic</u> (Typically PVC)
VOLTAGE (V)	600	600
OUTER JACKET	NYLON (or other equivalent)	NYLON (or other equivalent)

T90 is only recognized in Canada
THHN is recognized in the US and Mexico

9. NORTH AMERICAN WIRING PRODUCT AND RATING COMPARISONS

RW90 vs XHHW-2



STANDARD

CONDUCTOR

INSULATION

VOLTAGE (V)

OUTER JACKET

RW90



CSA C22.2 NO. 38

CU or AL

Thermoset

RW90: XLPE, EPCV,
EPR, Silicone,
Composite

RW90: 600, 1000,
2000, or 5000

OPTIONAL

XHHW-2



UL 44

CU or AL

Thermoset

XHH, XHHW, **XHHW-2:**
XLPE, EPCV
RHH, RHW, RHW-2: XLPE,
EPCV, Silicone, CP, CPE,
Composite, SBR/IIR, NR

XHHW-2: 600

XHHW: 600 or 1000

XHH: 600

RHH: 600, 1000, or 2000

RHW-2: 600 or 2000

OPTIONAL

XHHW/XHHW-2 compared to
RW90:

1. Additional horizontal flame test
2. Additional crushing resistance and glancing impact tests

9. NORTH AMERICAN WIRING PRODUCT AND RATING COMPARISONS

CSA TC vs UL TC

Unarmoured cables for use in cable trays

Note 1: UL Type "TC-ER" may transition between cable trays and utilization equipment or devices for up to 6 feet without continuous support.
 Note 2: Type TC-ER cables meet the crush and impact requirements of a UL Type MC cable.



	CSA TC (CANADA)	UL TC (US)		
	TC / TC-ER ¹	TYPE TC / TC-ER ^{1,2}	TYPE ITC / ITC-ER ^{1,2}	FOR CT USE
STANDARD	CSA C22.2 No. 230	UL 1277	UL 2550	VARIOUS
CABLES PERMITTED	CSA C22.2 No. 38 CSA C22.2 No. 75 CSA C22.2 No. 96 CSA C22.2 No. 96.1 CSA C22.2 No. 239 CSA C68.10 CSA C22.2 No. 49	UL 44 UL 83 UL 83A UL 66	Thermoset or Thermoplastic insulated conductors	UL 1072 UL 1569 UL 44 UL 83 UL 83A UL 66 ...
CABLE VOLTAGES	600 V – 46 kV	Up to 600 V	Up to 600 V	Up to 35 kV
KEY DIFFERENCES	Cables TC / TC-ER must pass the requirements in CSA C22.2 No. 230	Cables marked TC / TC-ER must meet requirements in UL 1277	Cables marked ITC/ ITC-ER must meet requirements in UL 2550	Cables marked "For CT Use" must meet requirements in the relevant standard

9. NORTH AMERICAN WIRING PRODUCT AND RATING COMPARISONS

FT4 vs IEEE 1202

Equivalent !!

70,000 BTU flame test for cables used in trays or shafts.

Cables are strapped to an 8-foot vertical section of ladder tray.

After burning the cables for 20 minutes, cable damage (char) shall not exceed 1.5 metres.

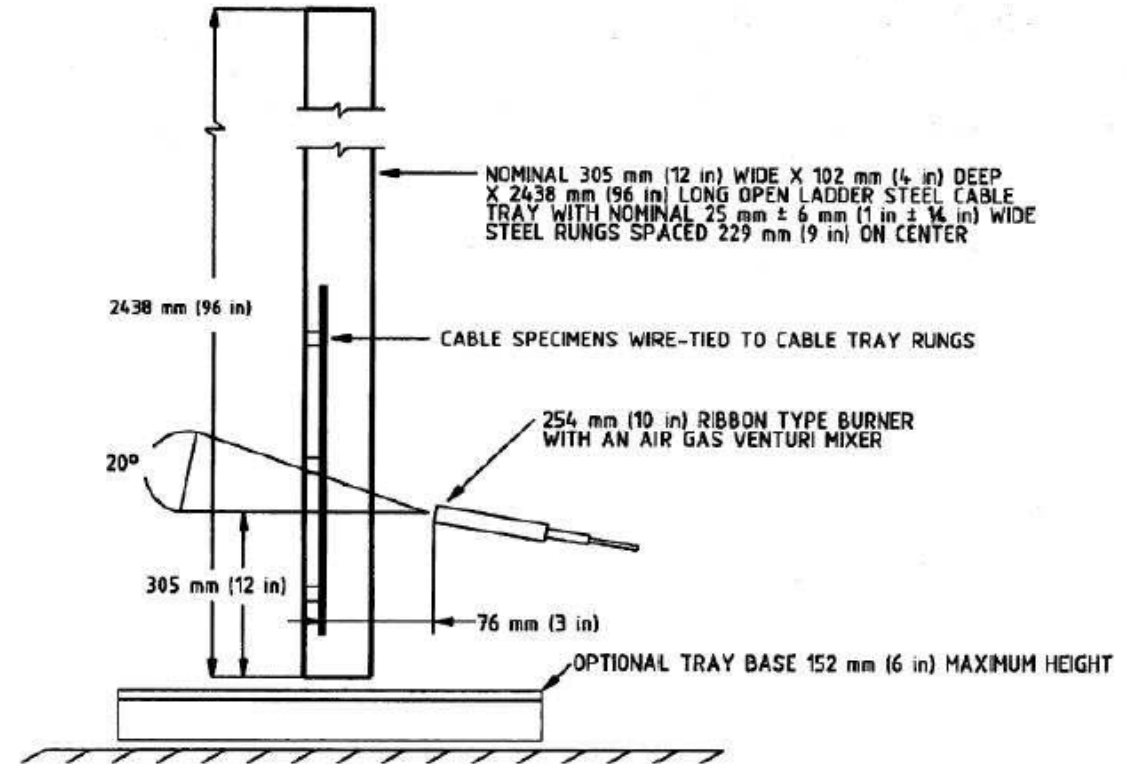


Image Source: IEEE 1202

9. NORTH AMERICAN WIRING PRODUCT AND RATING COMPARISONS

AC vs MC

	TECK90	ACWU90	MC
STANDARD	CSA C22.2 NO. 131	CSA C22.2 NO. 51	UL 1569
CONDUCTOR	CU or AL	CU or AL	CU or AL
INSULATION	Thermoset: RW90 XLPE RW90	Thermoset: RW90 Thermoplastic: T90 Nylon/TWN75 ($\leq 600V$)	Thermoset: XHHW-2, XHHW, XHH, RHH, RHW-2 Thermoplastic: TW, THW, THW-2, THHW, THHN, THWN, THWN-2
VOLTAGE (V)	600 – 5000	600	600 V (thermoplastic insulation) 600 - 2000 V (thermoset insulation)
INNER JACKET	YES	NO	OPTIONAL
ARMOUR	AIA	AIA	AIA or CWC
OUTER JACKET	YES	YES	OPTIONAL

Generic standard covering all metal-clad cables less than 2000V

Covered in Slide #32

TAKEAWAYS

Data centre designs have come a long way and continue to evolve.



Understanding the various types of data centres and requirements allows safe, efficient, reliable and compliant electrical designs.



Nexans has a wide range of products to suit your data centre needs.



Nexans environmental product declarations can help in efforts to obtain LEED credits and track the carbon footprint of your cables.



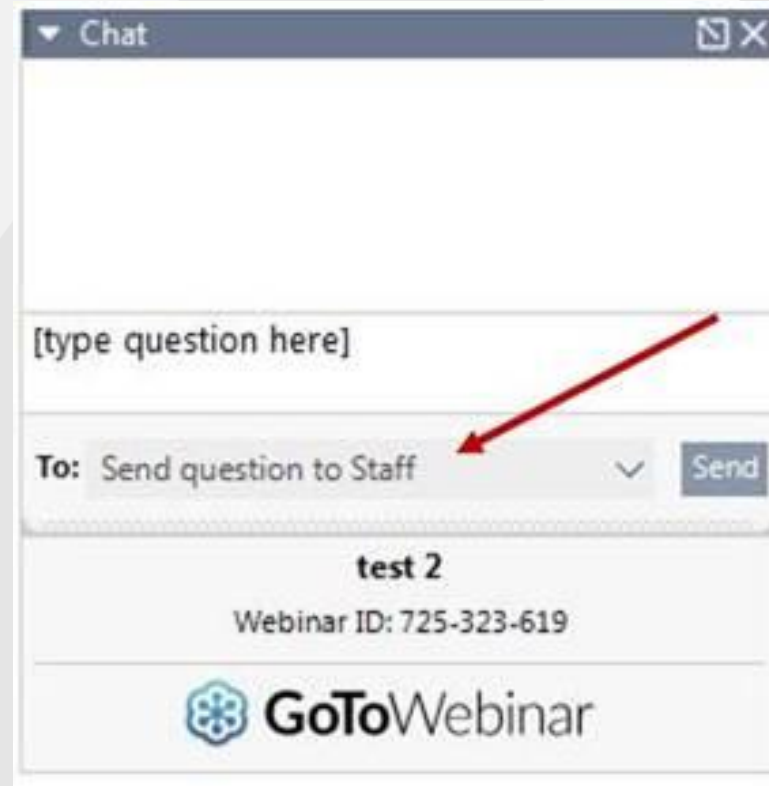
Leverage Nexans' knowledge and expertise by reaching out to our supply chain and engineering teams.



Understanding the difference between US & Canadian cable products / ratings allows you to tailor your designs to Canadian projects



Q&A



Contact us

Wissam Geahchan
wissam.geahchan@nexans.com

nexans.ca