ICC Docket 05-0675
Direct Testimony of Jeanne Muellner
AT&T Illinois Exhibit 4.0

Schedule JM-1

AC POWER
DC POWER
STB GEN
TO
POWER
AREA
TPASH

Commercial power is the power supplied by the electric utility company.

High voltage alternating current (AC) is transformed into low-voltages by the use of transformers.

Utility transformers for central office buildings are typically pole-mounted, pad-mounted or located in a vault within the building.

Figure 1: Pole-mounted transformers

Figure 2: Pad-mounted transformer

Figure 3:
Transformer vault inside building

Figure 1: Main service disconnect – Circuit breaker in stand-alone cabinet

Figure 2: Main service disconnect – Circuit breaker in main switchboard

Once inside the building, the commercial service is protected from overcurrent by a main service disconnect, typically one of the following:

1. **A circuit breaker in a stand-alone cabinet.**
2. **A circuit breaker in a main switchboard.**

The first level of AC power distribution in a central office is the main AC switchboard, at which branch circuit breakers feed the building loads.

Figure 1: Main AC Switchboard

A switchboard branch breaker may feed a second level of power distribution panelboards.

Figure 2: Distribution Panelboard Fed from Main Switchboard

Figure 1: Diesel Generator – 125 kW Size

Figure 2: Diesel Generator – 2000 kW Size

In the event of a commercial power outage, power is transferred to a stand-by generator, typically powered by a diesel engine.

The diesel-generator set is commonly referred to as a "genset".

Front View

Internal View

Figure 1: Stand-alone automatic transfer switch

Figure 2: Main automatic transfer switchboard with interlocked commercial and generator circuit breakers

The building AC loads transfer from commercial power to generator power by one of two means:

1. **A stand-alone transfer switch**
2. **Interlocked commercial and generator (emergency) circuit breakers located in a main AC transfer switchboard.**

Figure 1: Modern Power Plant with Shelf-Mounted Rectifiers

Figure 2: Older Power Plant with Floor-Mounted Rectifiers

The direct current (DC) power that feeds telephone equipment is generated from a "DC power plant" located within the central office.

A DC power plant consists of rectifiers, batteries, DC distribution panels and common bus bars to which these main components are connected.

Rectifiers "rectify" alternating current (AC) into direct current (DC).

Figure 1: Shelf-Mounted Plug-In Rectifiers

Figure 2: Floor-Mounted Rectifiers

Figure 1: Common Styles of PDSCs

Rectifiers operate on AC power supplied from a Power Distribution Service Cabinet (PDSC).

The PDSC itself is powered from an AC main switchboard or AC distribution panelboard.

The PDSC contains AC circuit breakers which power the rectifiers.

Figure 1: Typical circuit breakers at PDSCs

Figure 1: Common DC Power Plant Battery Types

Rectifiers operate in parallel with batteries and keep the batteries charged.

In the event of an AC power failure, the batteries will supply power to the loads.

The first level of DC power distribution is the DC powerboard (PBD).

The PBD itself is fed from the copper bus bars that connect the rectifier and battery outputs.

Figure 1: Common DC Powerboard (PBD) Styles

The DC power plant rectifiers, batteries and DC distribution panels are interconnected to copper bus bars.

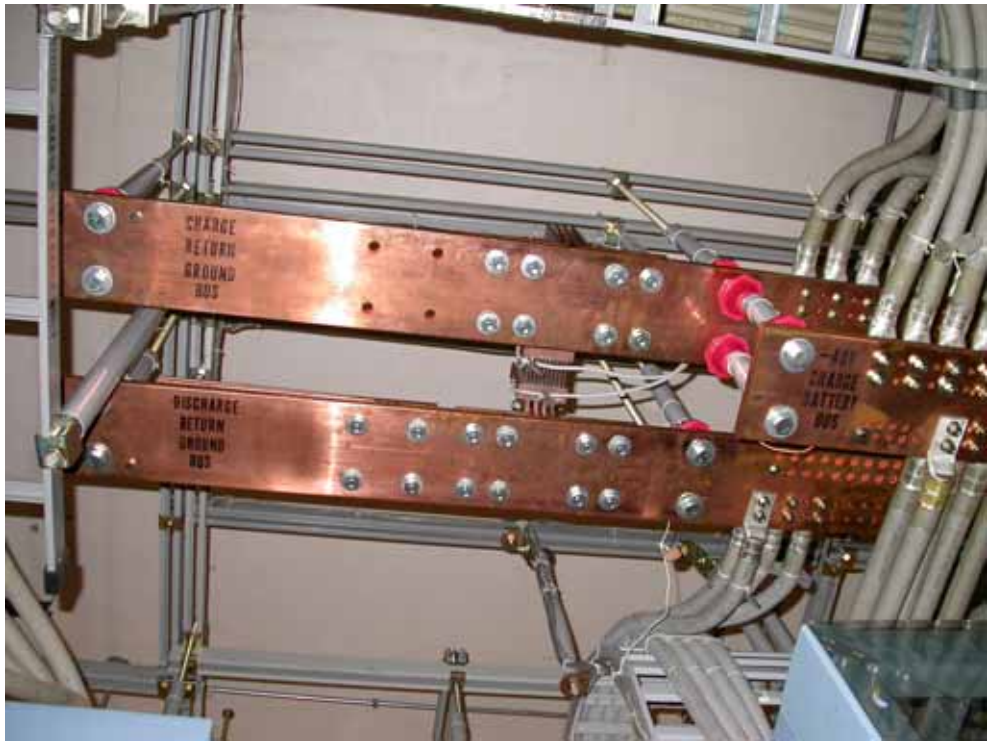

Figure 1: Common Bus Bar Arrangements for a Modern DC Power Plant

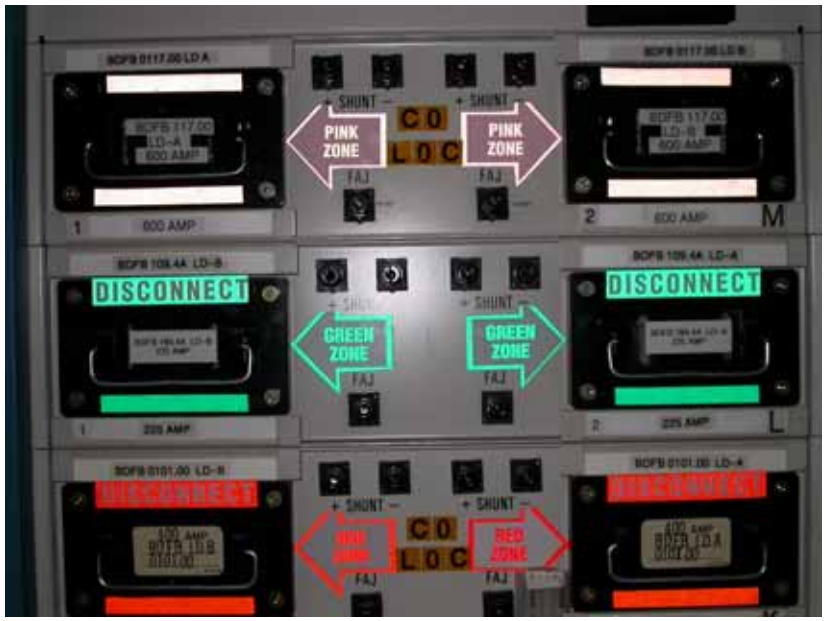

Figure 1: Enlarged View of Typical DC Powerboard (PBD) "Primary" Fuses

The DC powerboard (PBD) is a distribution panel that contains fuses which feed DC telephone equipment loads.

As the PBD is the highest level of DC distribution, it is considered "primary" power equipment.

Figure 1: Typical modern BDFB

The second level of DC power distribution panels is called a Battery Distribution Fuse Bay (BDFB) for toll telephone equipment.

As the BDFB is the second level of DC distribution, it is considered "secondary" power equipment.

Figure 1: Typical Switch PDCs

The second level of DC power distribution panels is called a Power Distribution Cabinet (PDC), Power Distribution Fuse (PDF) Cabinet, or similar name, for switch telephone equipment.

As the PDC, etc. is the second level of DC distribution, it is also considered "secondary" power equipment.

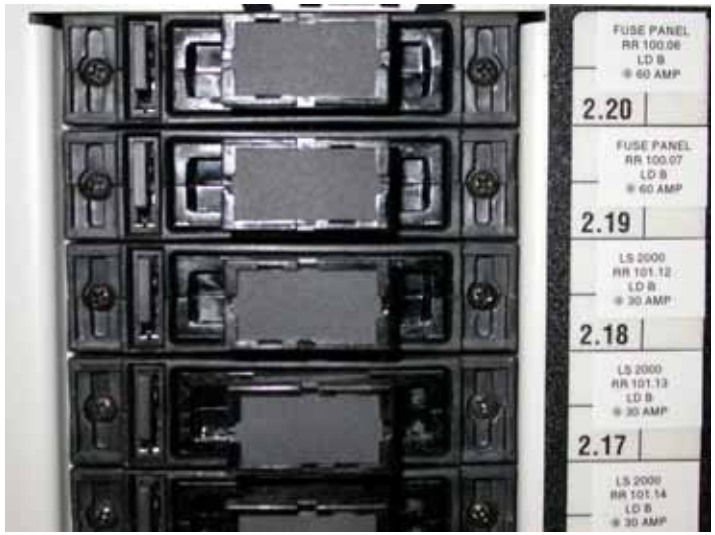

Figure 1: Enlarged View of BDFB Fuses

Figure 2: Enlarged Views of Switch PDC Fuses

Figure 1: Typical CLEC equipment cage

Figure 2: Typical ILEC toll equipment bay line-up in which CLEC bays may be installed

CLEC equipment bays may be installed in separate cages, or may be installed alongside the ILEC equipment bay line-ups.

A CLEC equipment bay is typically powered from a BDFB. A battery lead and a return lead are installed from a BDFB to a CLEC equipment bay.

Figure 1: Typical Fuse and Alarm Panel at CLEC Bay – Front View

Note: The Fuse and Alarm Panel (FAP) may be considered a third or "tertiary" level of DC power distribution.

Figure 2: Typical Fuse and Alarm Panel at CLEC Bay – Rear View

Green wire: Frame ground

Gray wires: Battery and return from BDFB

Red/black wire pairs: Battery and return leads to individual CLEC bay shelves

The return lead is terminated at “shunt bars” as it is routed from the BDFB to the CLEC equipment bay.

Figure 1: Shunt Bars

NOTE: One side of the shunt is the “Power Side” from the BDFB, and the opposite side of the shunt is the “Customer Side” to the CLEC equipment bay.

Shunt bars are installed near the CLEC's equipment to measure the voltage associated with the electrical current usage.

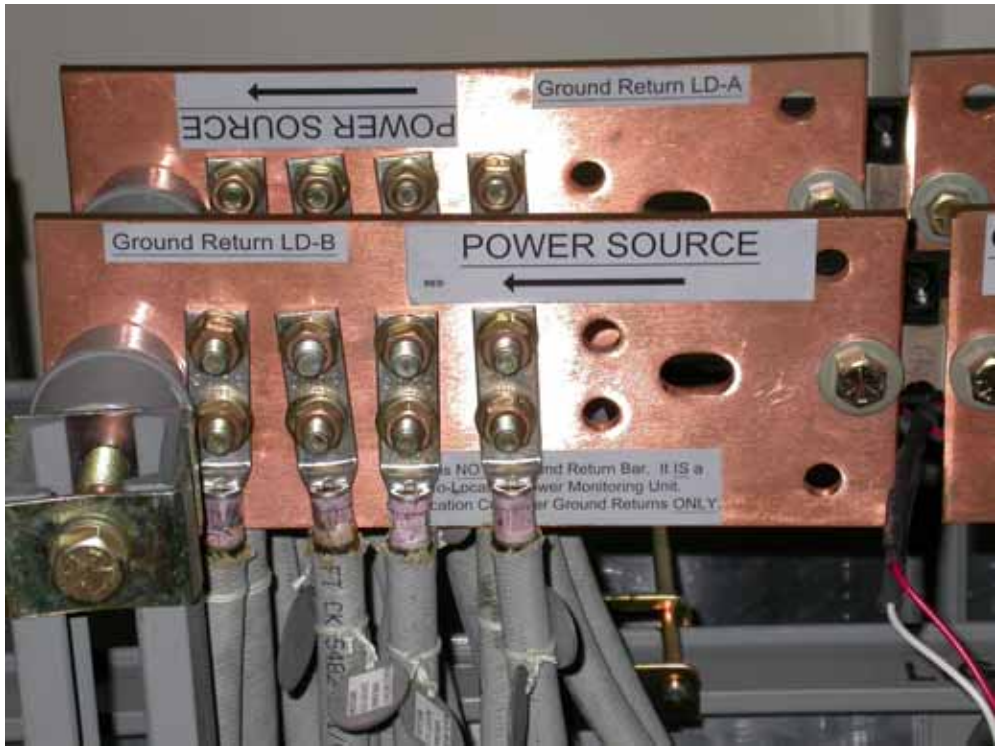

Figure 1: The "Power" Side of a Set of Shunt Bars - Used for Cables from the BDFB

(The Opposite Side Not Shown is the "Customer" Side for Cables to the CLEC Bay)

Gray wires: CLEC power return leads

Red and white wire pair: Shunt leads to PMU

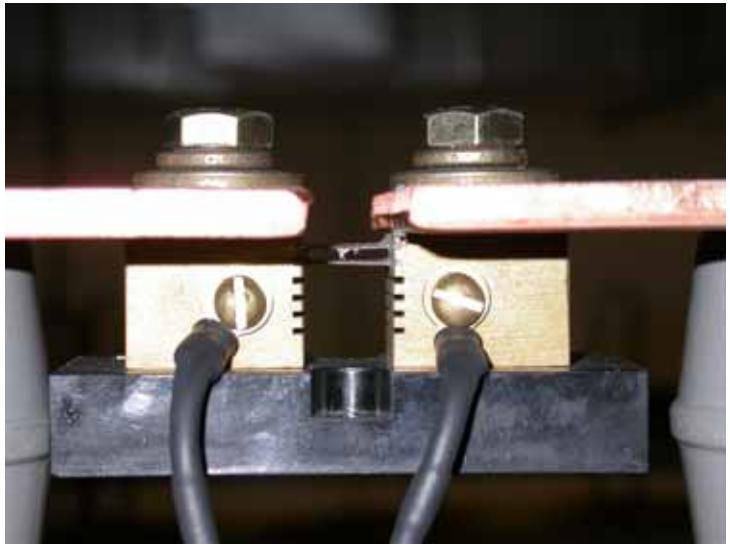

Figure 1: Shunt (with Leads) at Shunt Bar

A shunt is a resistive device that converts electrical current into a (milli)voltage signal.

Figure 2: Shunt Leads at the Rear of a PMU

The voltage signal is sent to the PMU by way of "shunt leads" connected between the CLEC shunts and the PMU.

Figure 1: PMU – Front View

CLEC power/energy usage is monitored with a Power Metering Unit (PMU).

The PMU is a rack-mounted unit that converts a CLEC's electrical current usage into kilowatt-hours for billing purposes.