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Engineered to order. Built to last.

Improving Reliability with Submersible Installations

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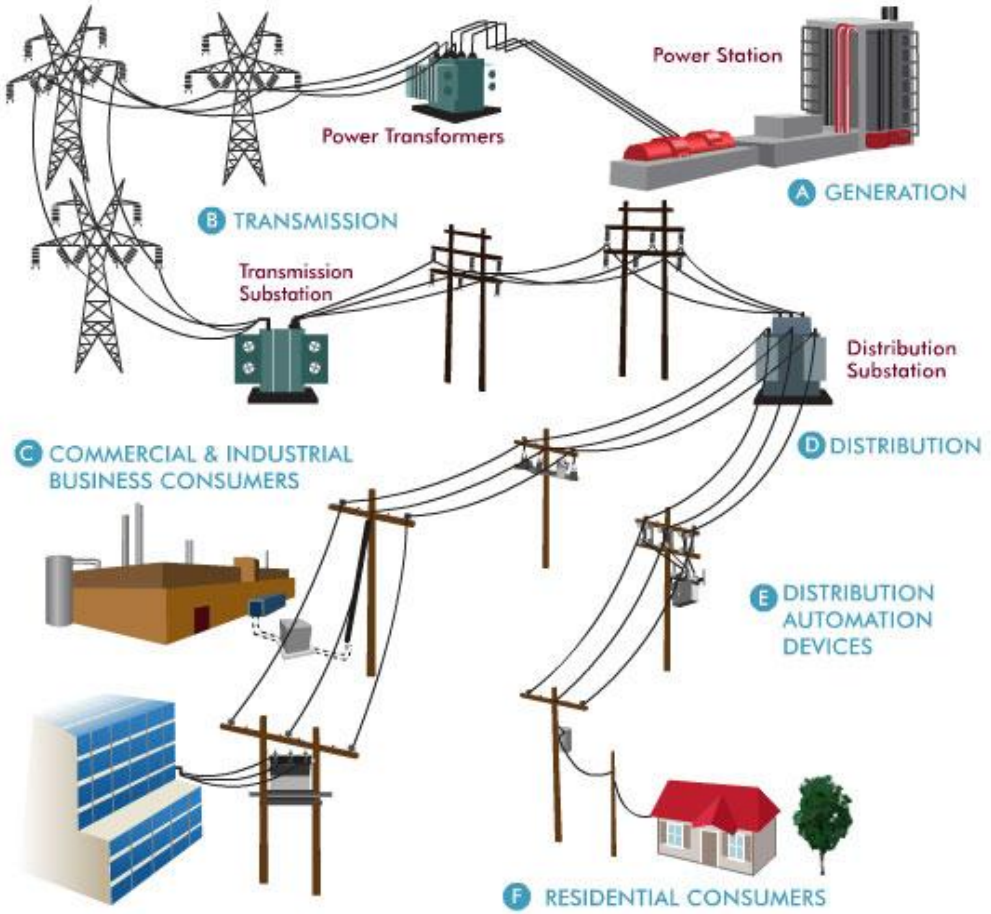
G&W Underground Distribution Switchgear



- 11 – 38 kV
- Insulation – gas, solid dielectric
- Pad mount, vault
- Switching and protection

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Yearly Power Interruptions per 100km of Circuit

(per the Edison Electric Institute)

Utility	Voltage	Overhead	Underground
Integral Energy	HV	30.3	2.8
Integral Energy	LV	7.4	7.7
Energy Australia	HV	13.0	4.0
Citipower	HV	4.0	1.0
Mercury Energy	HV	30.5	7.1
Survey of Australian Utilities	HV & LV	23.6	5.6
France	LV	12.3	7.6
Finland	LV	8.0	4.0
Average		**16.1**	**5.0**

Note: km = kilometer, HV = high voltage, LV = low voltage

Underground is over 3 times more reliable

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Benefits of Going Underground

- Increased aesthetic appeal
- Not susceptible to storm damage or damage from vehicles
- Service interruptions less frequent
- Equipment failures contained in vaults and ducts, decreasing environmental concerns
- Decreased maintenance from problems caused by environmental factors such as dust and contamination
- Reduced maintenance cost

Benefits of Going Underground (con't)

- Longer asset life
- Reduced transmission losses due to use of larger conductors
- Reduced greenhouse gas emissions
- Increase safety (reduced electrocutions)
- Reduced fire risks to the public
- Increased property values

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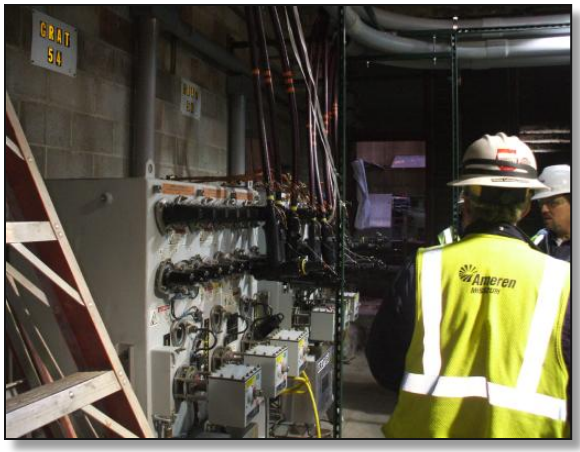
General Installation Photos

Typical pad mount switch
Green enclosure mounted in the public

Typical wet vault or sub surface switch
Vaults are under the street or sidewalk



Typical dry vault or equipment room switch
Found in basements or dedicated buildings

Underground Installations

Issue – water, contaminants, foreign material can greatly reduce the life of equipment

Solution – submersible equipment

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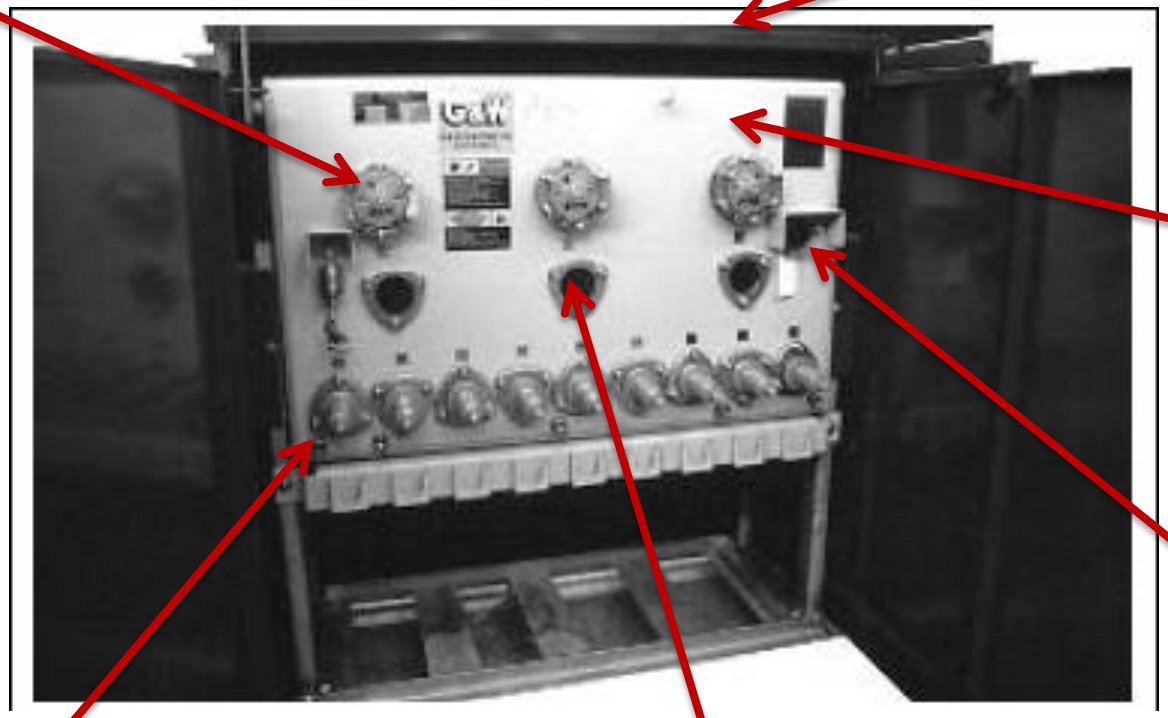
Typical applications

- Fault (short circuit) protection
  - Fault protection in the switch prevents damage to cables and other expensive components like transformers
- Sectionalizing
  - A switch that breaks up the line into smaller sections
  - Makes maintaining and servicing the “grid” easier
- Loop switching
  - Multiple sources feeding a loop of switches. Each switch has multiple loads
- Transfer switching
  - A switch with 2 sources going to it. One source feeds the loads then transfers to the other source if it’s lost

Typical SF6 Switch



PADMOUNT ENCLOSURE

SWITCH OPERATOR

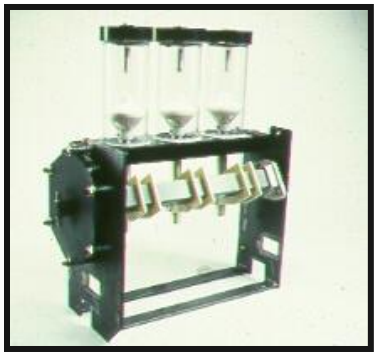
WELDED STEEL TANK

PRESSURE GAUGE

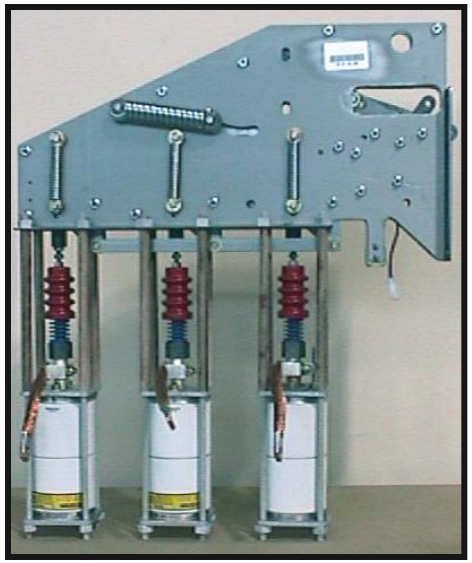
POWER CONNECTIONS (BUSHINGS)

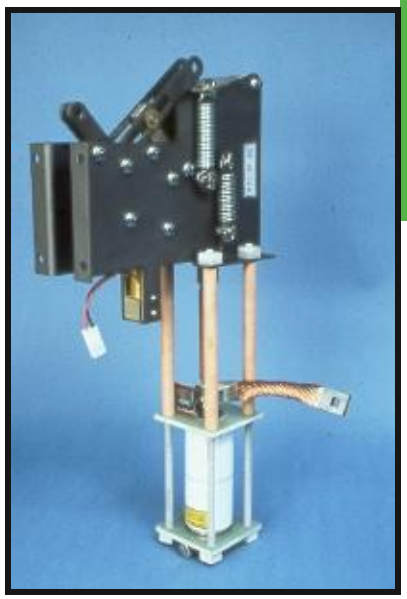
CONTACT VIEWING WINDOWS

What's in the typical switch?



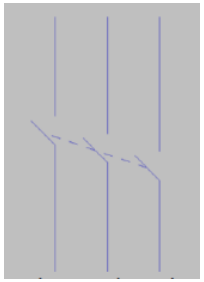
Load Break Modules
•Use SF6 to quench arc current during load break
•Load current capability for hundreds of amps





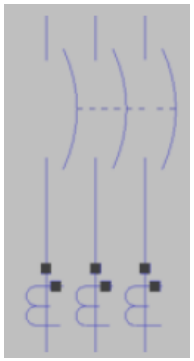
Resettable Vacuum Fault Interrupters
•Fault current interrupted in vacuum bottle
•Interrupting capability up to 25kA

Basic Terms Defined



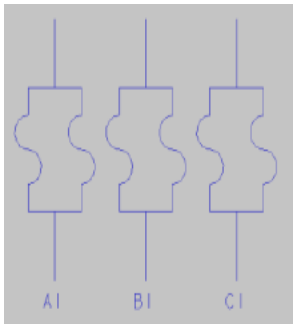
Load Break Switch

- Used to sectionalize a line when there is a problem or maintenance required.
- In loops they isolate sources



Fault Interrupter

- Used to interrupt fault current (short circuits)
- Resettable mechanism
- No fuses or consumable parts
- Current is interrupted in a vacuum



Fused Way

- Used to interrupt fault current (short circuits)
- Current Limiting
- Fuse must be replaced after it operates

Basic Voltage Ratings Defined

- **Maximum Operating Voltage**
  - 3 Voltage Classes:
    - 11kV (up to 17kV)
    - 25kV (up to 29kV)
    - 35kV (up to 38kV)

- **AC Withstand Rating**
  - It's a test that lasts for 1 minute at high voltage
  - Each voltage class has an AC Withstand rating defined by the standards
  - 35kV for 15kV class, 40kV for 25kV class, 50kV for 35kV class

- **Basic Impulse Level (lightning rating)**
  - Often abbreviated as "BIL"
  - Short time voltage surge rating
  - Each voltage class has a BIL rating defined by the standards
  - 95kV/ 110kV for 15kV class, 125kV for 25kV class, 150kV for 35kV class

Submersible Switches

- Cover all ratings, features and options for ANSI, Medium Voltage Distribution switches
- Hermetically sealed steel tank for long life
- Submersible construction for all designs
- Dead front construction
- Maintenance free
- Resettable Fault Interrupters with VI Control for Overcurrent Protection or optional Microprocessor relay
- 2-position switching (external grounding with connectors) or 3-position switching (with integral ground)

Typical Options for Submersible Switches

- Stainless steel tanks and enclosures
- Monitor gas pressure remotely (low pressure alarm)
- Auxiliary contacts to monitor whether the switch is open or closed remotely
- Microprocessor relays (instead of self powered controls) for fault protection
- Motors, controls, current and voltage sensing for automation
- Automatic Source Transfer Controls for critical loads
- Add voltage transformer for control power

ANSI Switch Standards

- ANSI/IEEE 37.71
- ANSI/IEEE 37.72
- ANSI/IEEE 37.74

Standard for subsurface, vault and pad-mount load interrupter switchgear

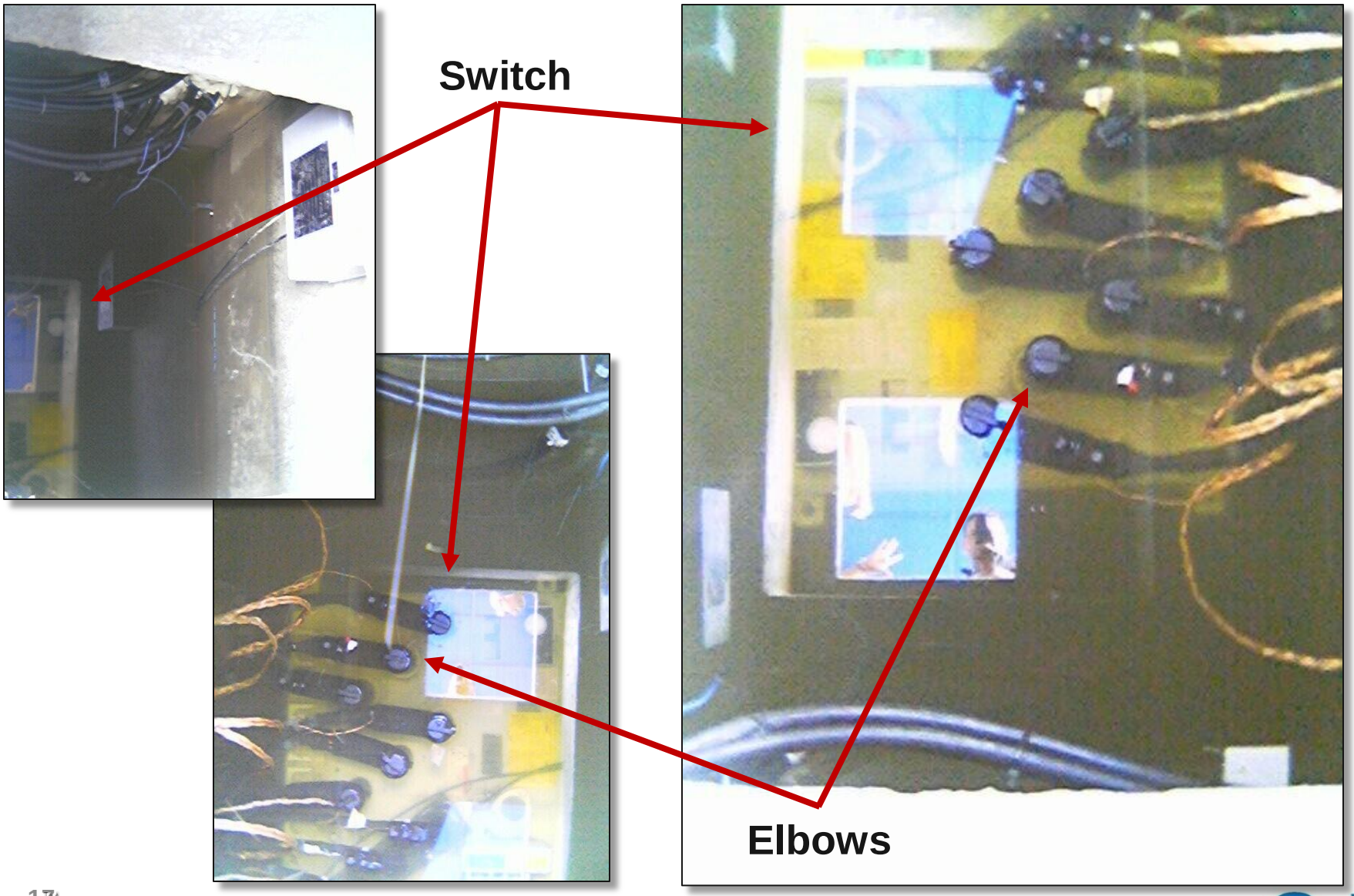
- ANSI/IEEE 37.60 — Standard requirements for pad, vault and submersible fault interrupters

Amperes	Number of Operations	Close-Open	Open
25,000	16	6	10
12,500	56	19	37
4,500	44	15	29

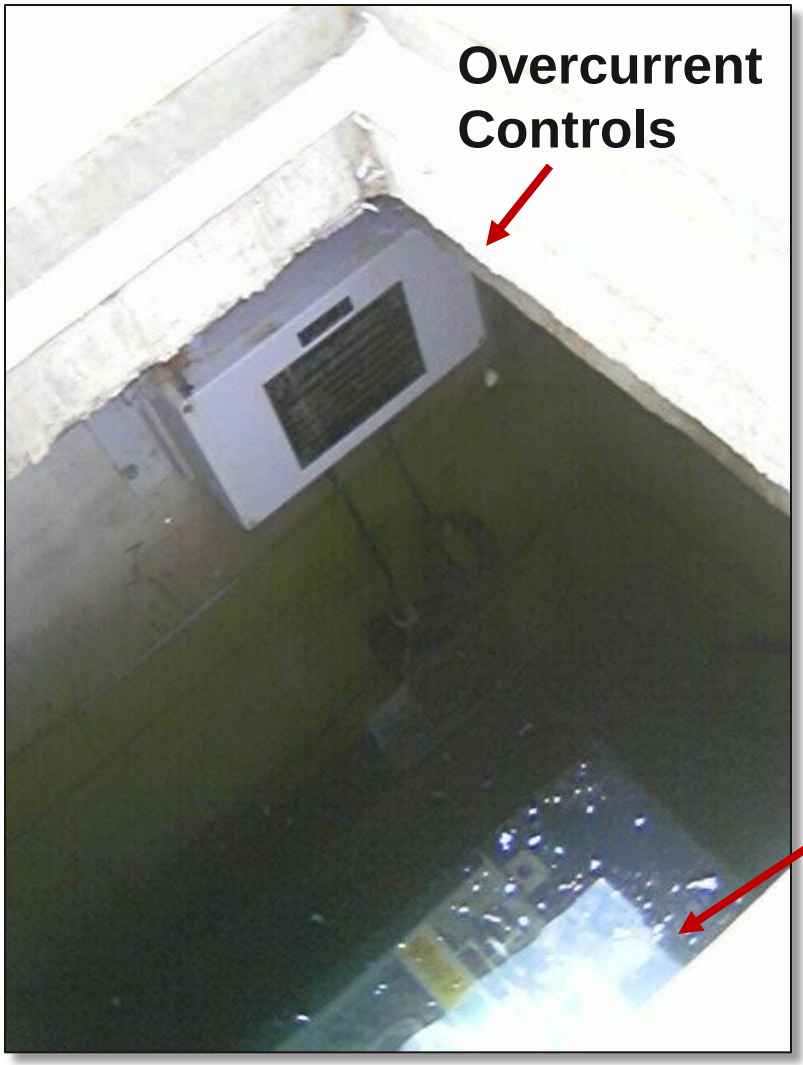
Vault Switch Maintenance

- No internal maintenance is required
- 30 year service life
- Check gas pressure prior to any operation
- Check gas pressure a minimum of 1x per year.
- 304 Stainless Steel available on any style switch if corrosion is a concern

Submersible Switchgear



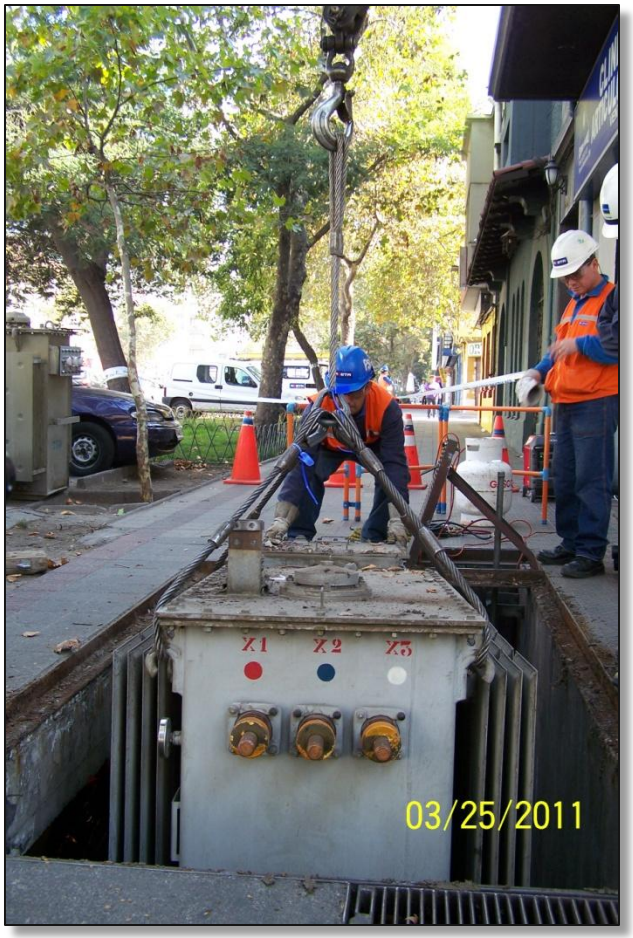
Submersible Switchgear



Switch

Vault Access

Submersible Substation Installation



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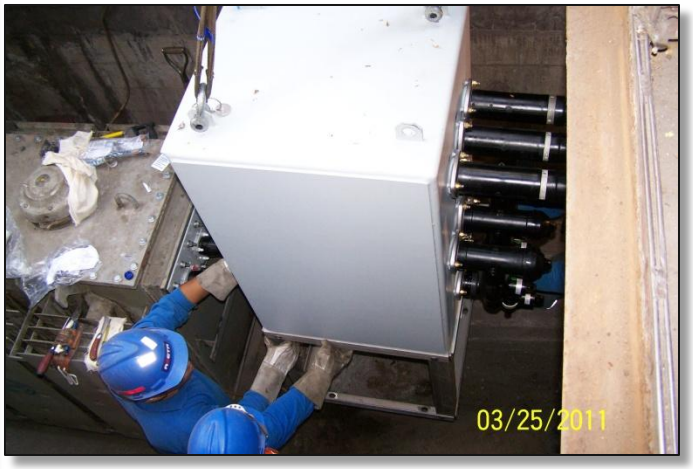
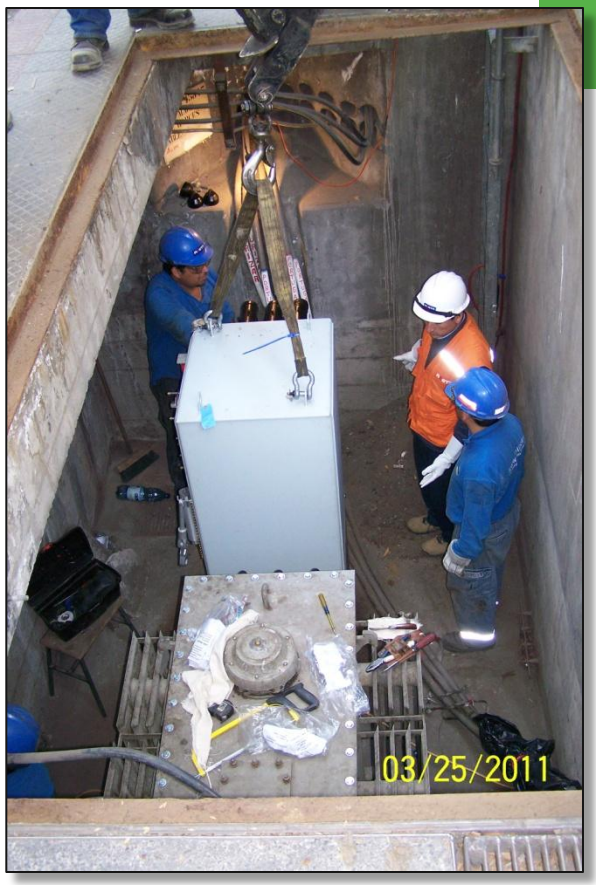
Submersible Substation Installation

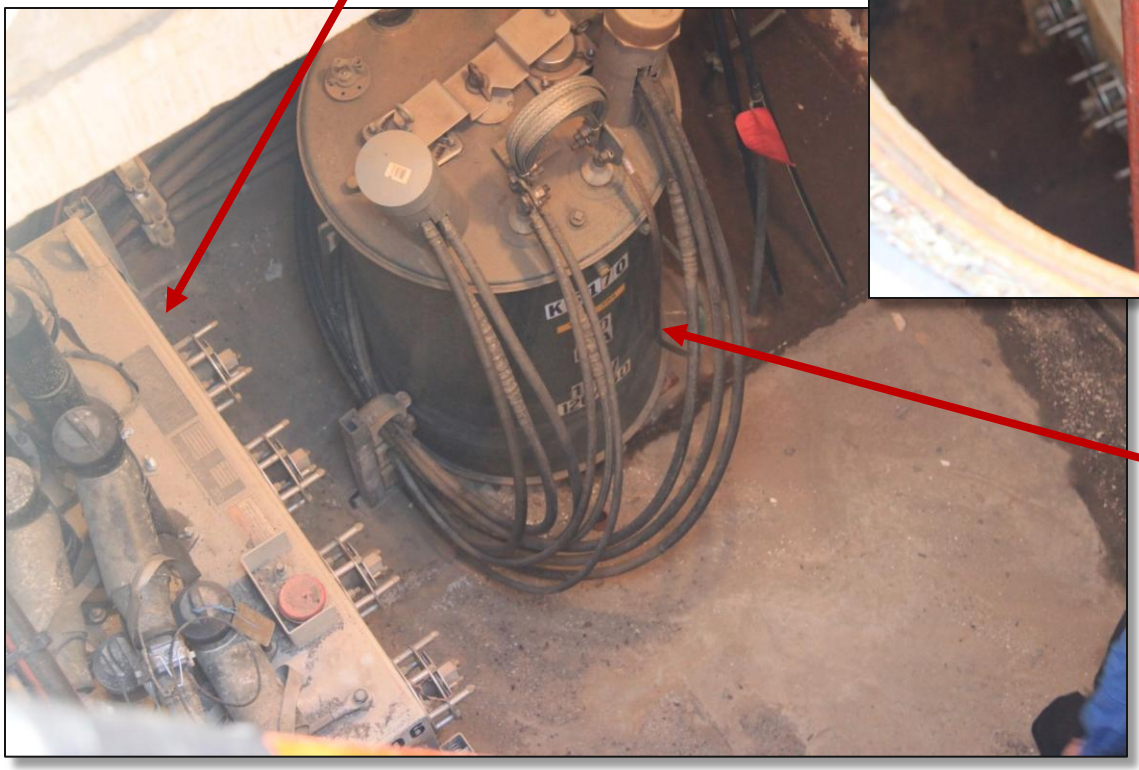




Submersible Substation Installation

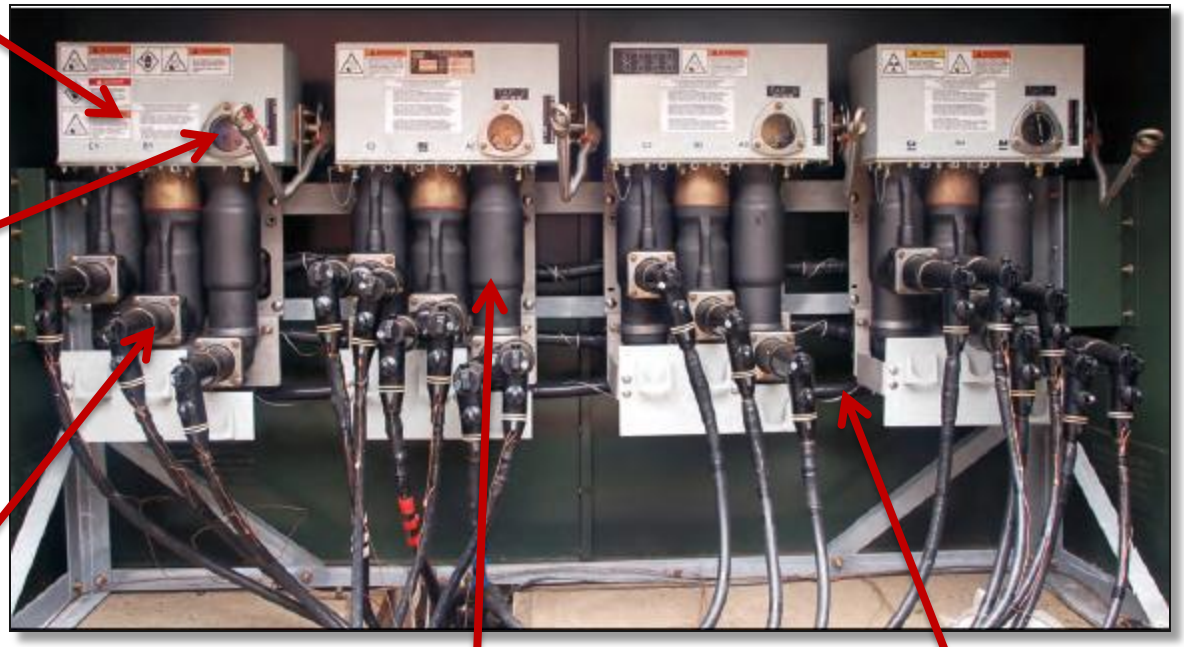
Submersible substation view

Switch



Transformer

What does a Solid Dielectric Switch look like?



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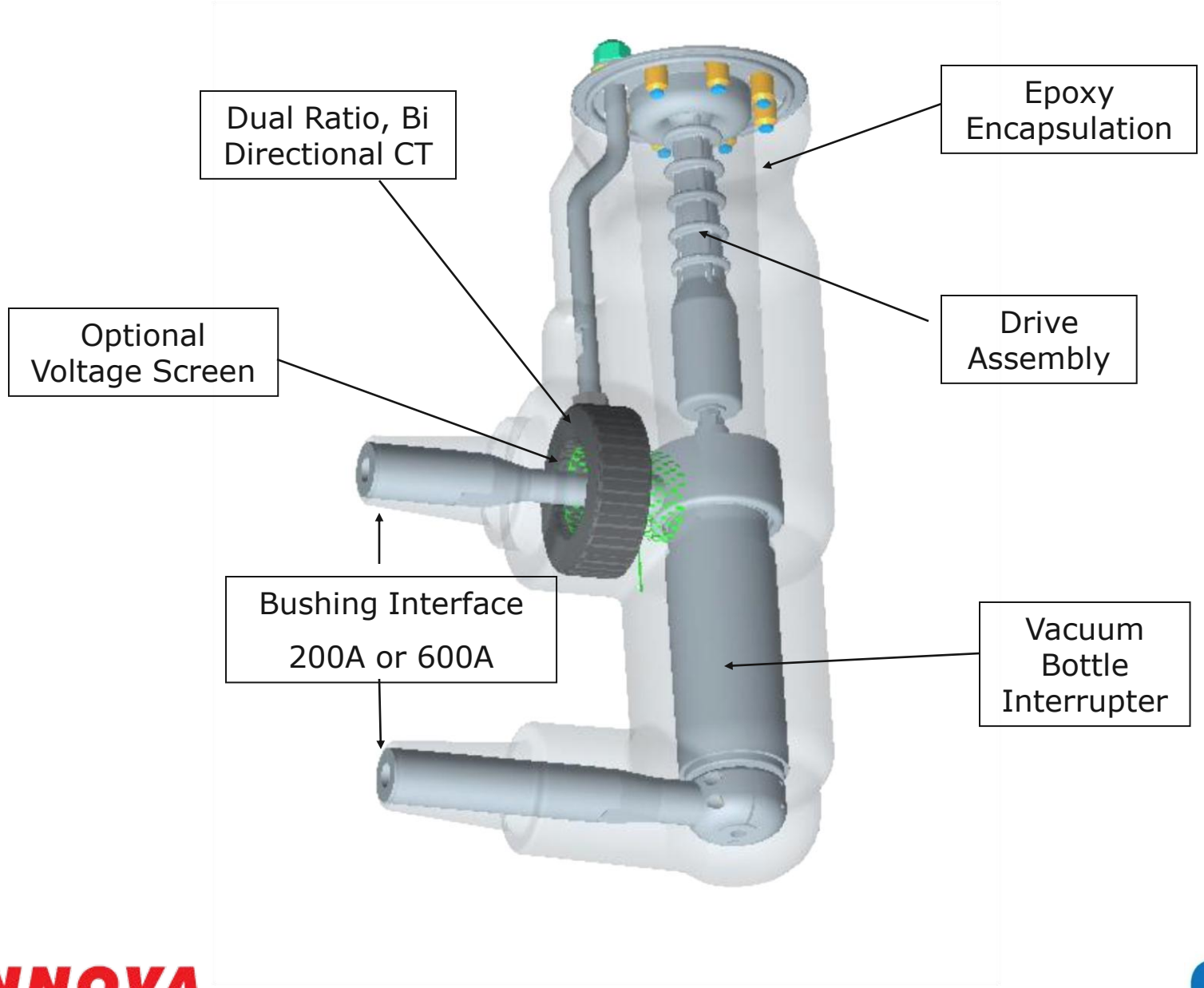
What's inside the module?



Modular Design: 4 different versions to connect together

Trident-S

3-phase

Spring mech

Trident-ST

3-ph with 1-ph trip

Spring mechanism

Trident-SP

1-phase

Spring mechanism

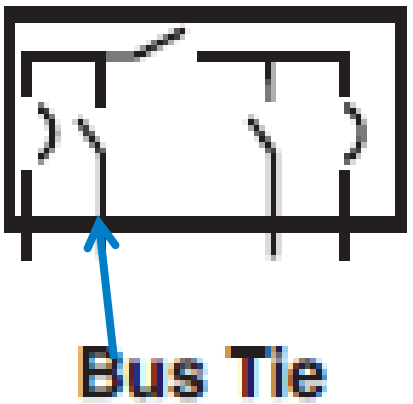
Trident-SR

Magnetic actuator

Submersible Vault Installations

Key Features

- G&W offers a magnetic actuator
  - High speed auto transfer 8-10 cycles
  - High speed switch operations in 3-4 cycles
  - 10000 mechanical operations
  - Ideal for automated applications
- We have tested for submersibilty
  - IP68 rating; 3m of water; 4 years of submersion
- Extremely robust construction
- Bus tie configuration available



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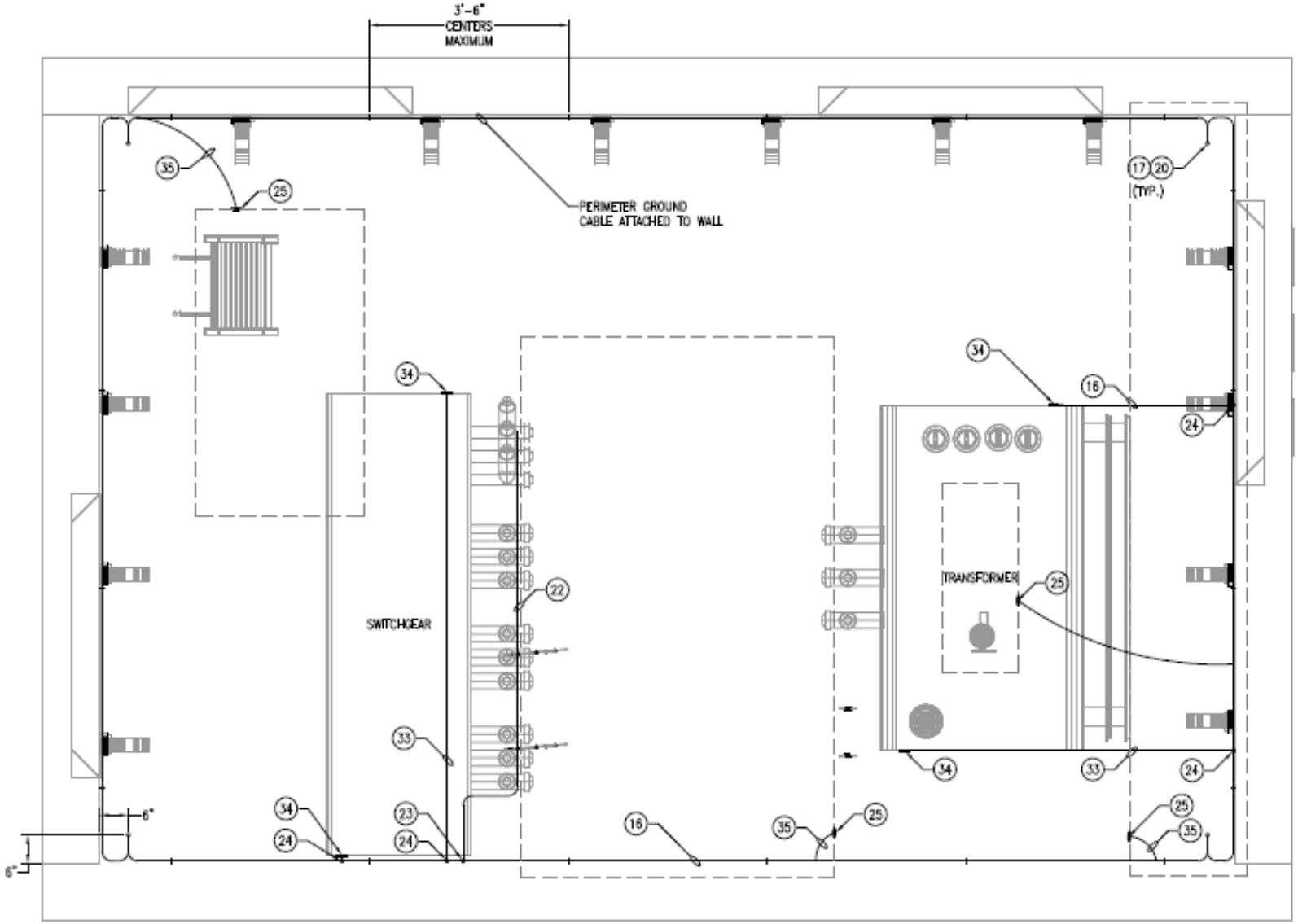
Safety with Solid Dielectric

Visible break in solid dielectric switchgear – G&W is the only manufacturer

Typical Vault Layout



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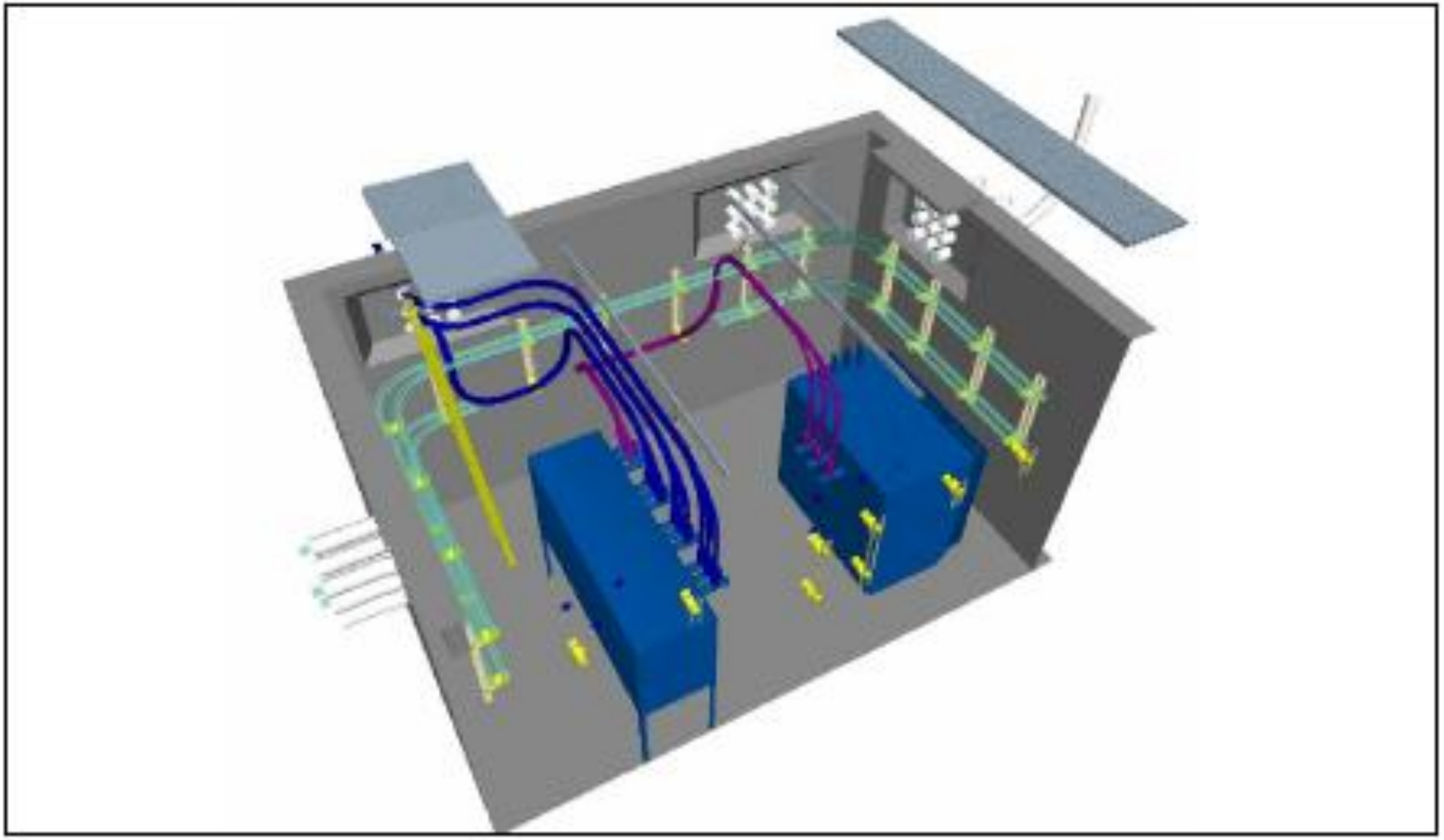
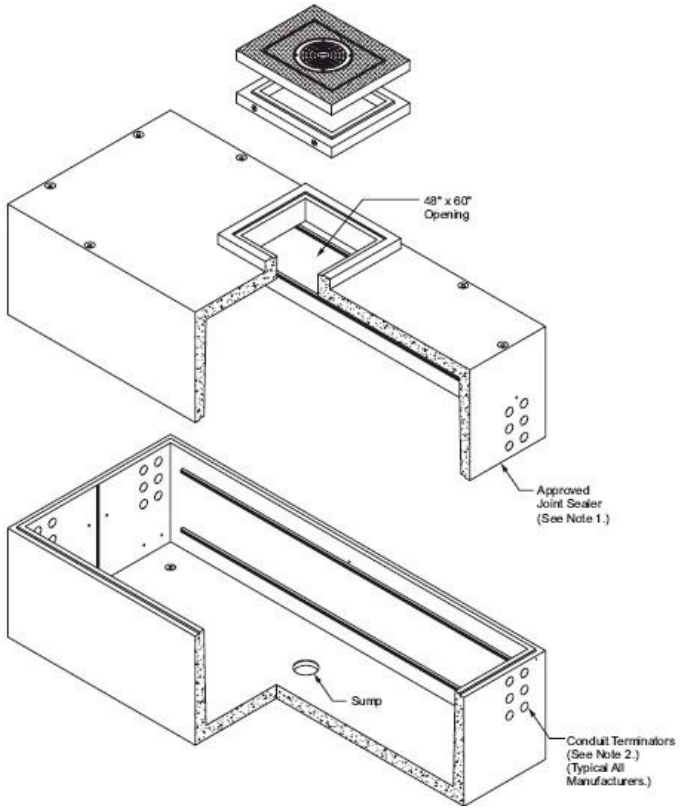
Typical Vault Layout



Precast Vaults



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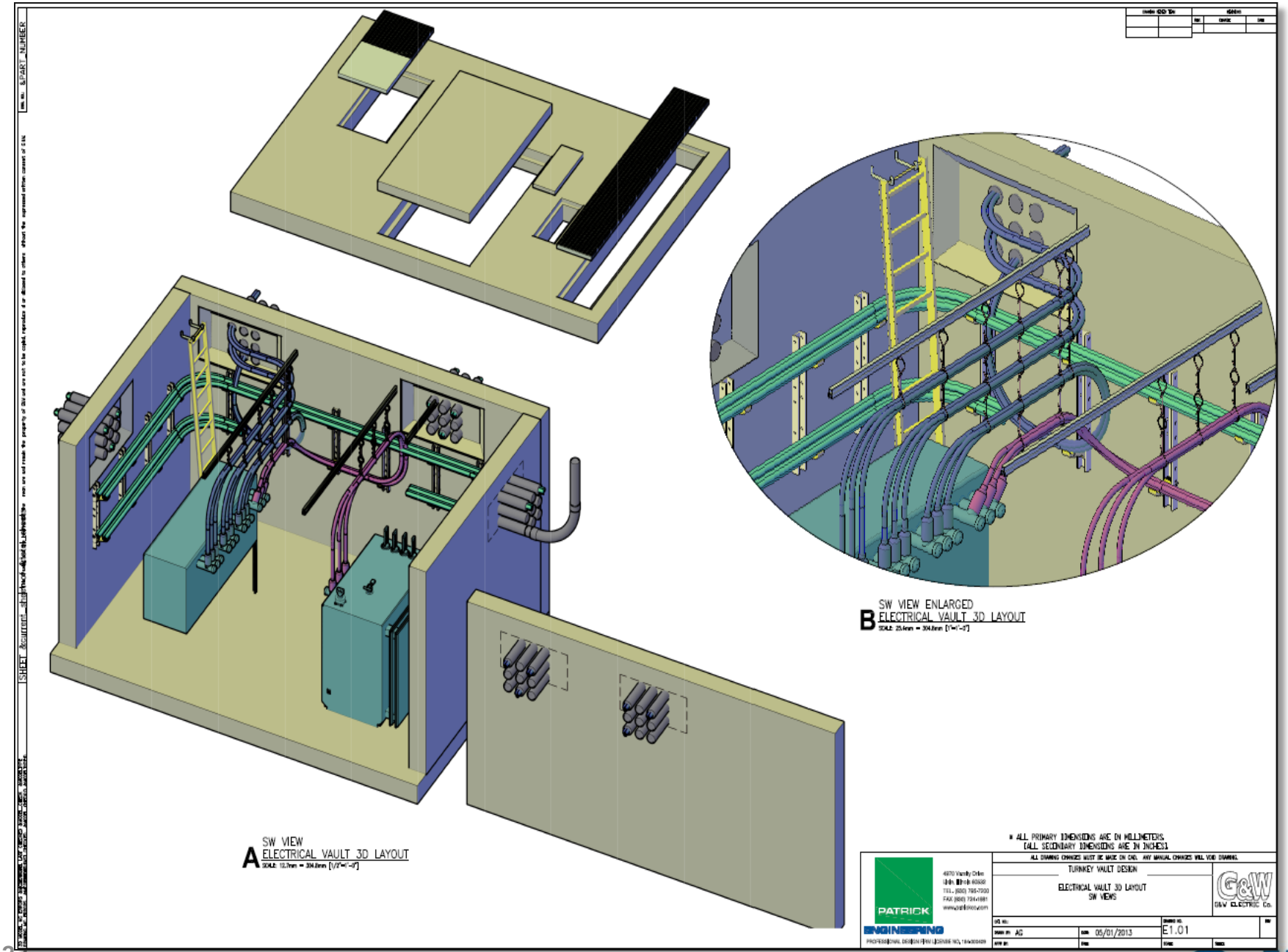
A SW VIEW
ELECTRICAL VAULT 3D LAYOUT
B SW VIEW ENLARGED
ELECTRICAL VAULT 3D LAYOUT
ALL PRIMARY DIMENSIONS ARE IN MILLIMETERS.
ALL SECONDARY DIMENSIONS ARE IN INCHES.
ALL DRAWING CHANGES MUST BE MADE ON CAD. ANY MANUAL CHANGES WILL VOID DRAWING.
TURNKEY VAULT DESIGN
ELECTRICAL VAULT 3D LAYOUT
SW VIEWS
PATRICK
ENGINEERING
G&W
G&W ELECTRIC Co.
AG
05/01/2013
E1.01

A History of Submersible Success

Over 500 Vault Switchgear Users

Over 20,000 submersible design switches sold since 1972

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