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Discoverer Enterprise
Dynamic Positioning Conference
October 13-14, 1998

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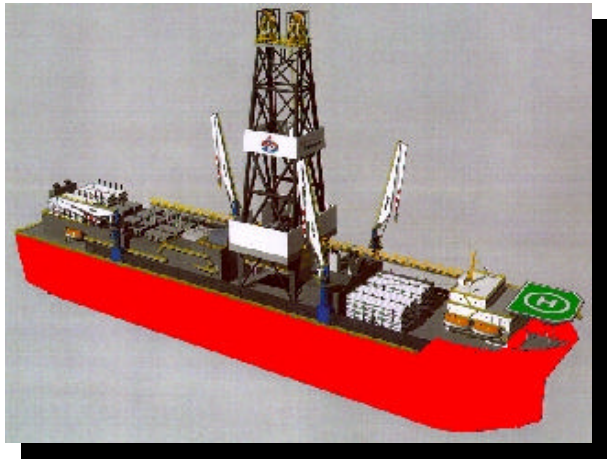
Discoverer Enterprise



Ship characteristics	
Length, oa	254.4 m
Length, bp	240.0 m
Breadth	38 m
Depth	19 m
Service speed	14 knots
No.of passengers	200

Main electrical propulsion characteristics

Electric propulsion :

- 6 x 5.22 MW, 0 - 790 rpm motors
- 6 x twelve pulse synchrodrive convertors
- 12 x 3187 kVA transformers

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Cegelec Scope of Supply

- 11kV Switchboards
- 11kv Harmonic Filters
- 11kv/480V Service Transformers and Switchboards
- 11kV/630V Drilling Transformers and Switchboards
- 6x 5.22MW Thruster Systems Comprising
  - 11kV Transformer, 12 Pulse Pair
  - Synchroconvertor Variable Speed ACDrive
  - AC Synchronous Motor

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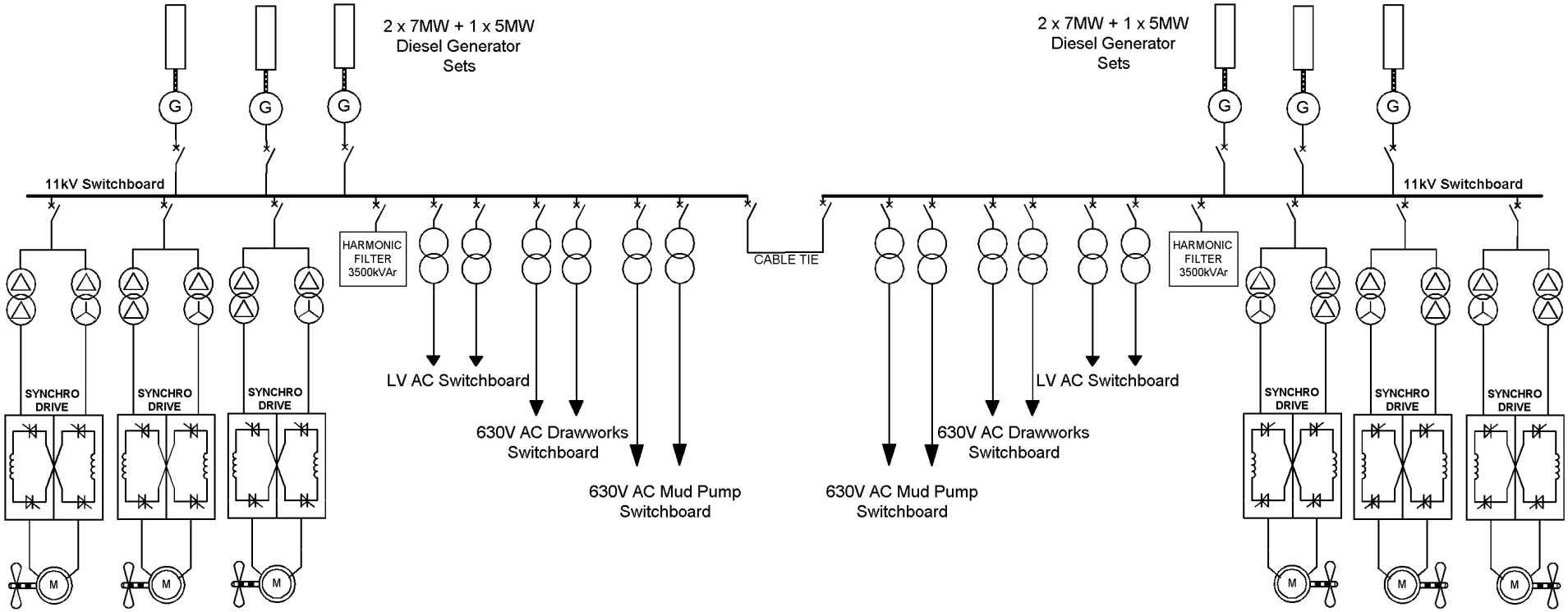
Single Line Diagram of 11kV Power System



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Introduction to Synchrodrive

- Variable Speed
- Variable Frequency
- Fullly Regenerating
- Fully Reversing
- Synchronous Motor
- High Efficiency
- Fuseless
- Simple
- Robust

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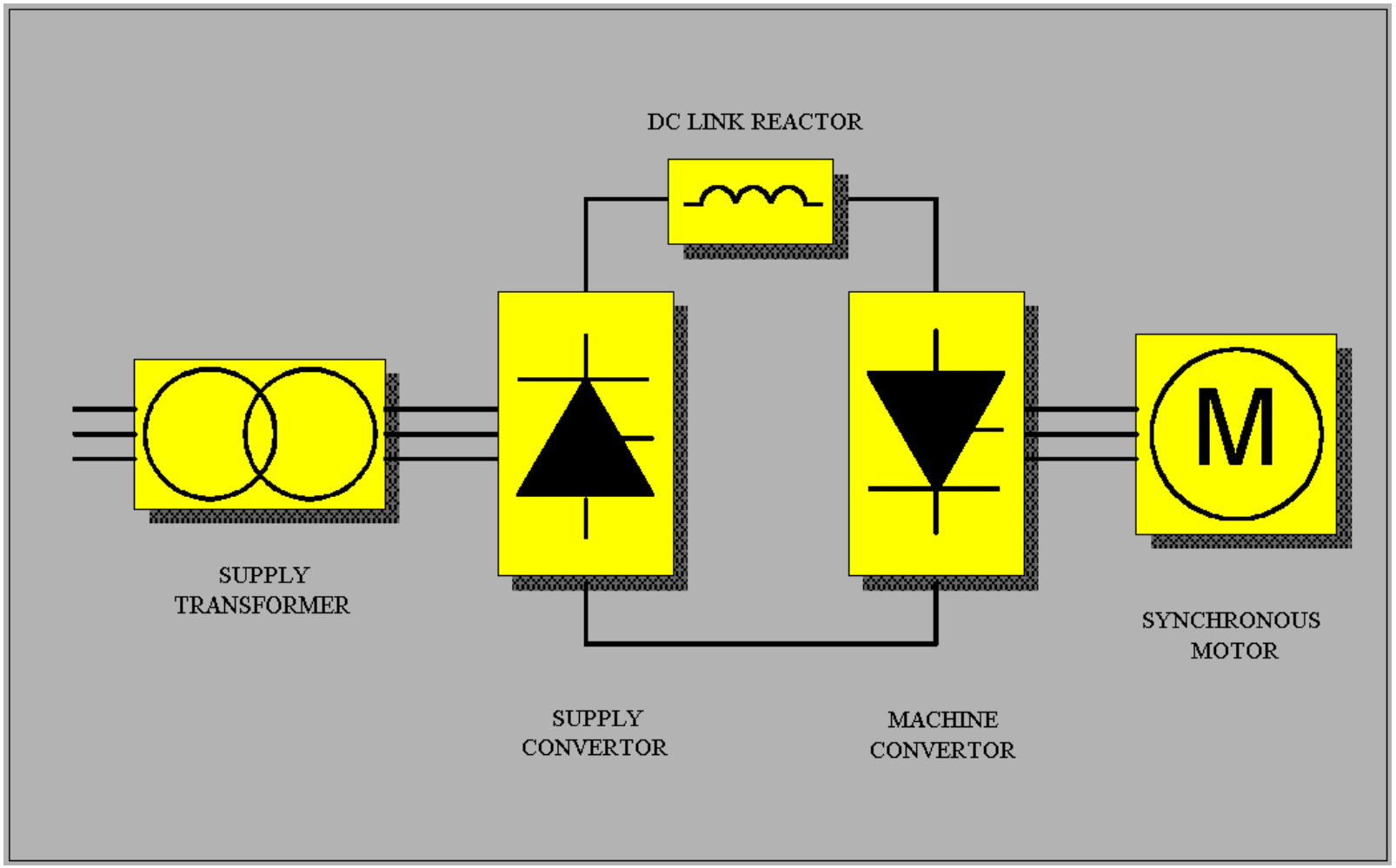
Basic Synchroconvertor Circuit Diagram



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Synchrodrive Features

- Load Commutated Current Source Inverter
- Machine Bridges - Mains Frequency
- Supply Bridges - Motor Frequency
- DC Link with Reactors
- Mode 1 - Force Commutated
- Mode 2 - Naturally Commutated
- Standard Power Thyristors
- Encoder for Low Speeds Only
- Highly Tolerant of Supply Voltage Dips

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Mode 1 Operation

- Low Speed Operation
- Typically +/-10% Speed
- Encoder Used for Rotary Position Feedback
- Forced Commutation
- Supply Bridges used for Commutation

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Mode 2 Operation

- Natural Commutation of Thyristors
- Machine Generated Voltage
- Above 10% Speed in Either Direction
- Speed Feedback using Machine Generated Voltage
- Position Feedback using Machine Generated Voltage

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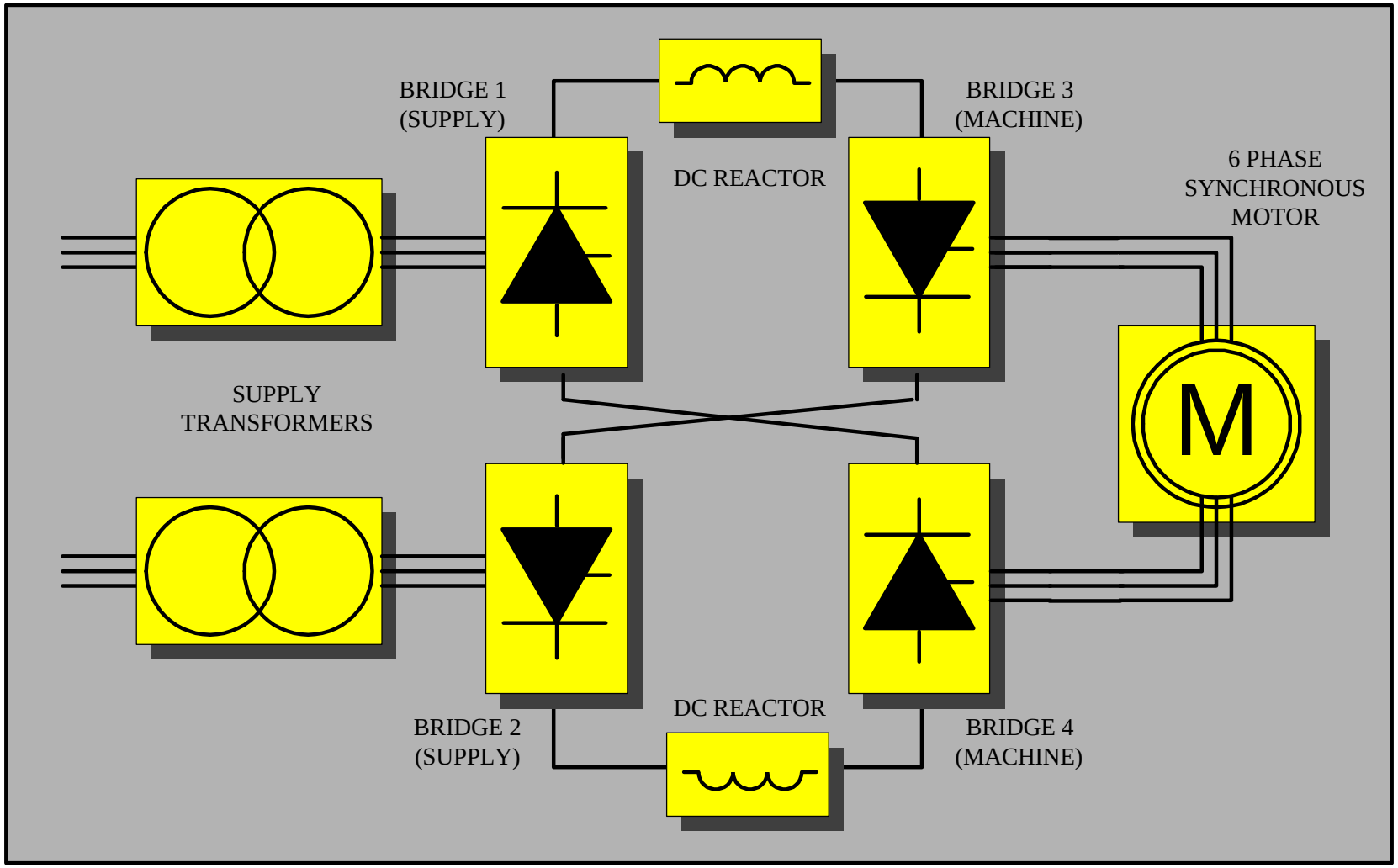
Synchroconvertor Circuit Used In This Application



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Drive Supply Transformers

- 1 x 12 Pulse Pair per Drive
- 2 x 3187 kVA
- Ratio: 11kV to 2x1266V
- Primary Connections: Delta
- Secondary Connections: Star/Delta
- 6% Impedance
- Vector Group Dy11/Ddo

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Thruster Motor

- Synchronous Motor
- 5.22 MW
- Vertically Mounted
- Closed Air/Closed Water (CACW) Cooling
- Brushless Excitation
- 0-720/790 RPM
- 0.9 PF
- 2x3 Phase, 30 Degrees Displaced
- 0-52.7Hz
- 1250V a.c.

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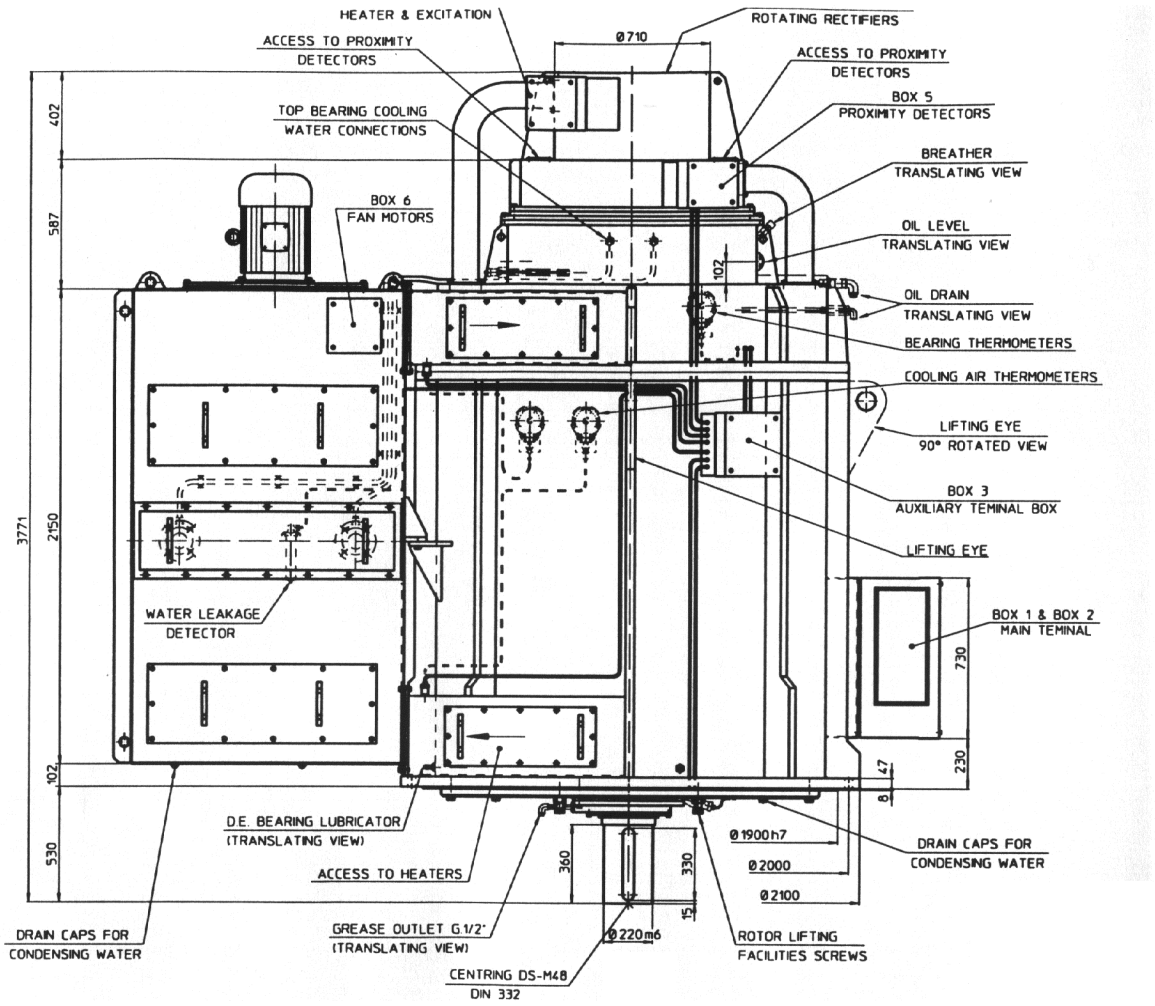
Thruster Motor



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Discoverer Enterprise Synchrodrive

- Mk10 Convertor
- Closed Air/Closed Water (CACW) Cooling
- 5.22 MW per Thruster Drive
- Supply Voltage (Transformer Secondary) 2x1266 V a.c.
- Output Voltage (To Motor) 2x1250V a.c.
- 12 Pulse
- 2 Supply Bridges
- 2 Machine Bridges
- 1 Double Unit DC Reactor
- 12-1-1 + 12-1-1 Interleaved Connection

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Mk 10 Synchroconvertor Cubicle Suite Arrangement (Air Cooled Variant)

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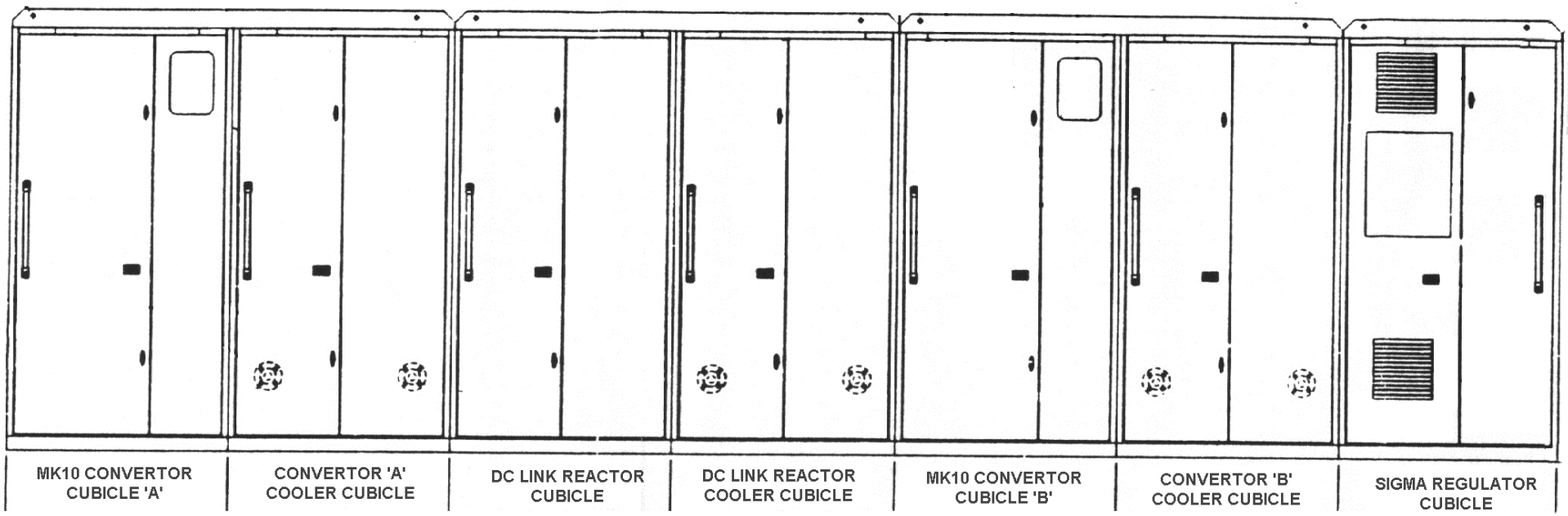
Thruster Sychrodrive Cubicle Arrangement



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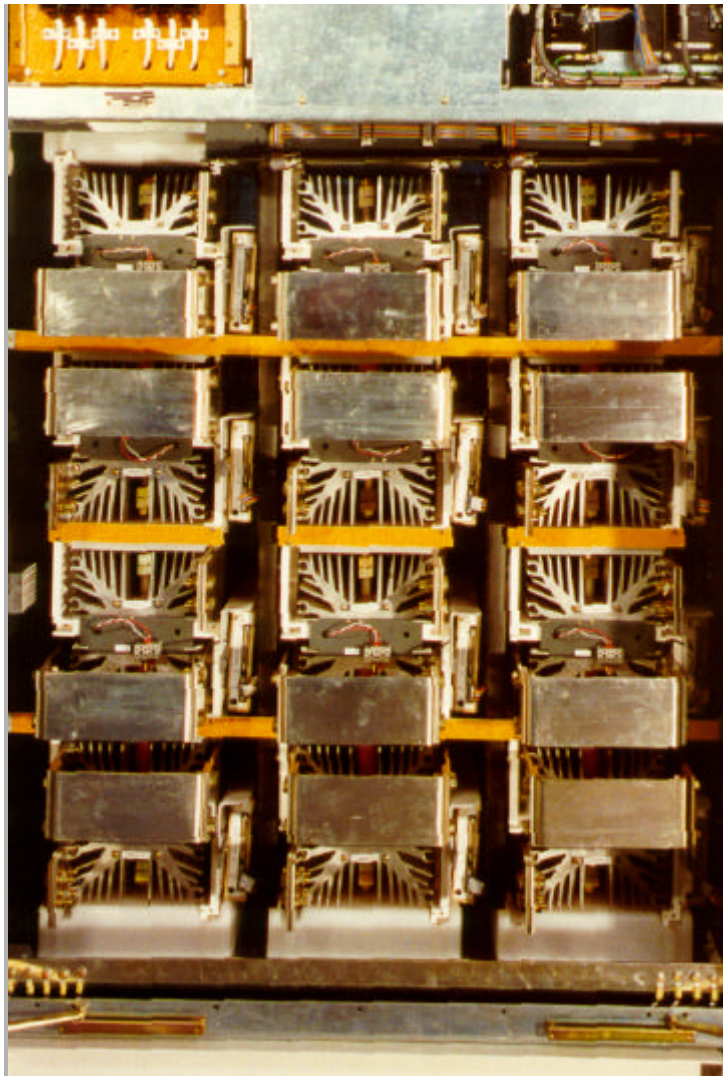
Thyristor Convertor Front View



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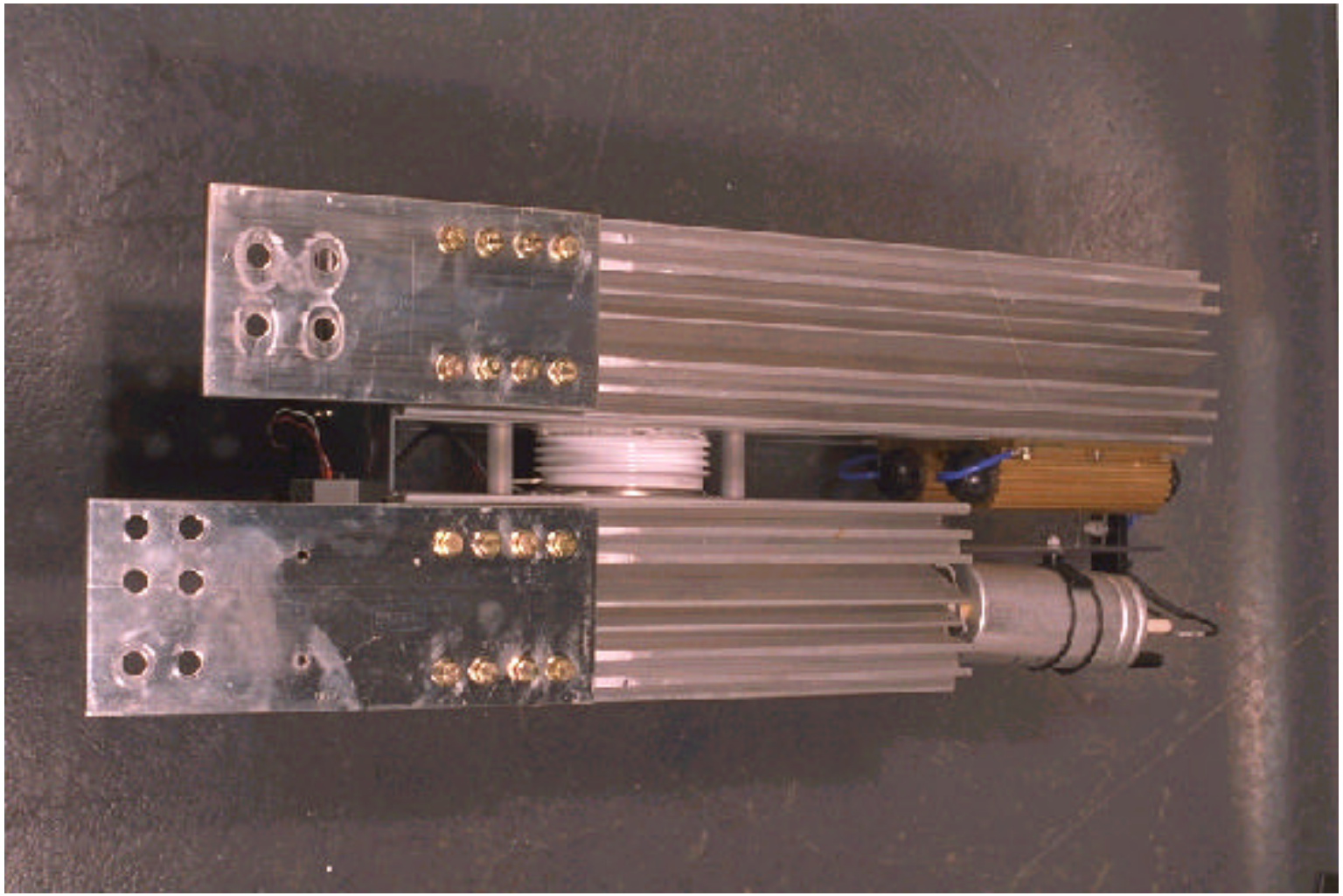
Mk 10 Thyristor Module



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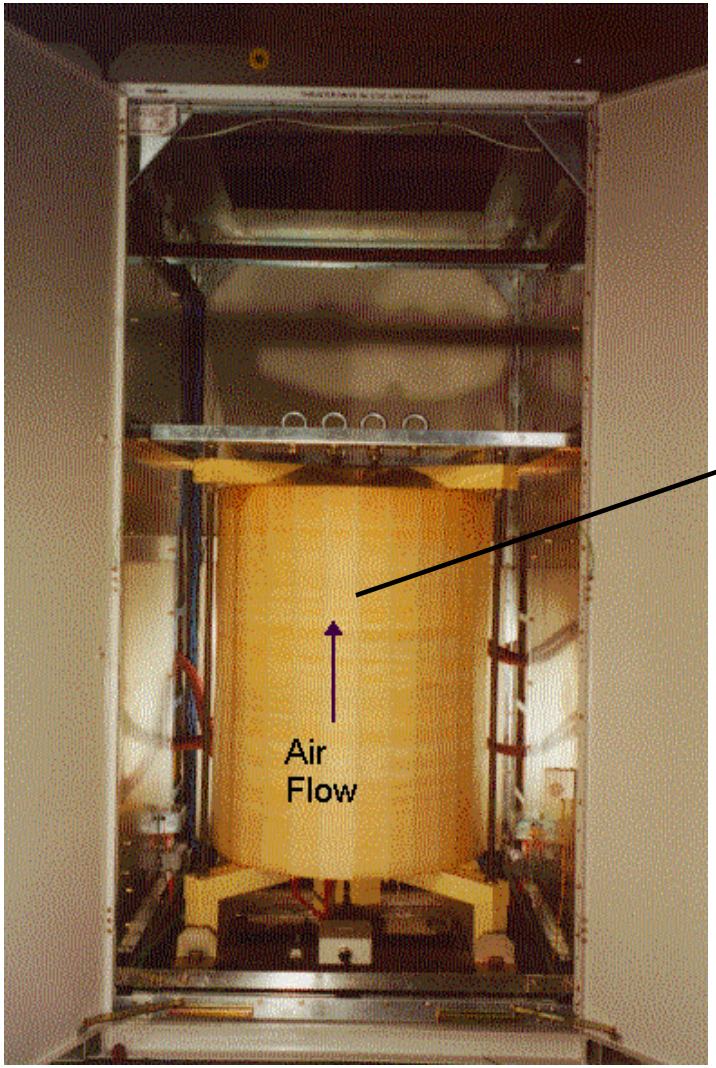
DC Link Reactor Cubicle



Air Cooled DC Link Reactor

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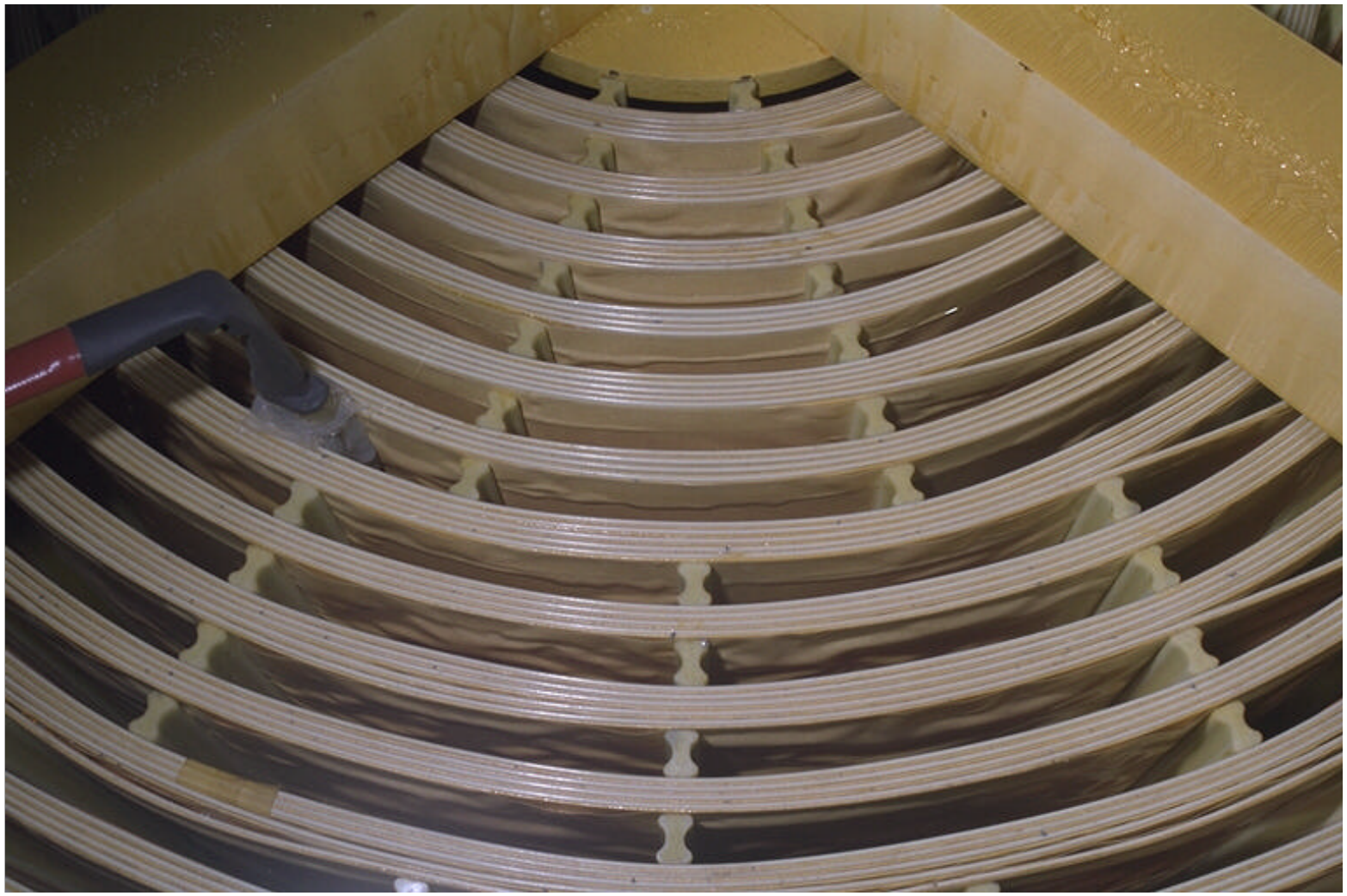
DC Reactor Construction



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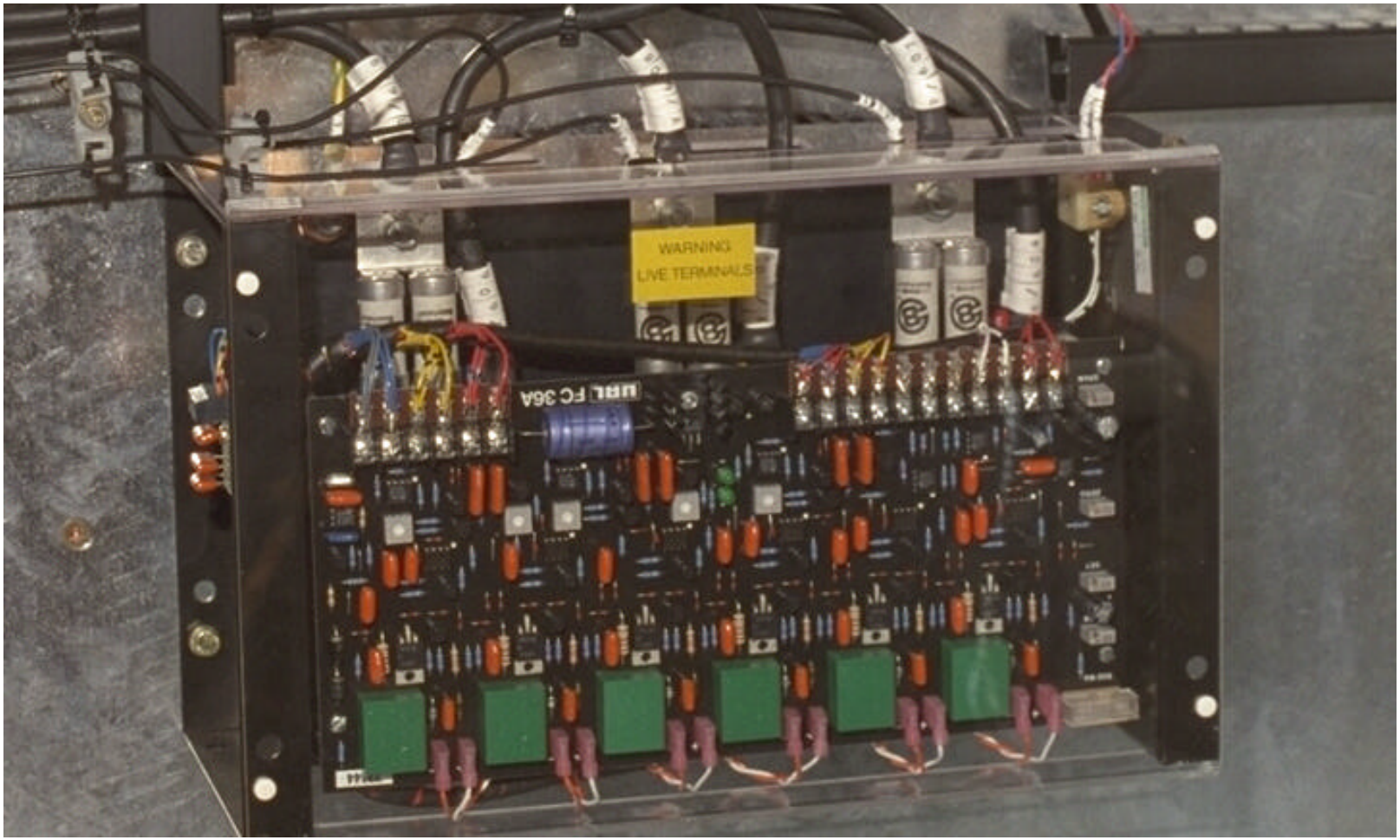
Excitation Controller



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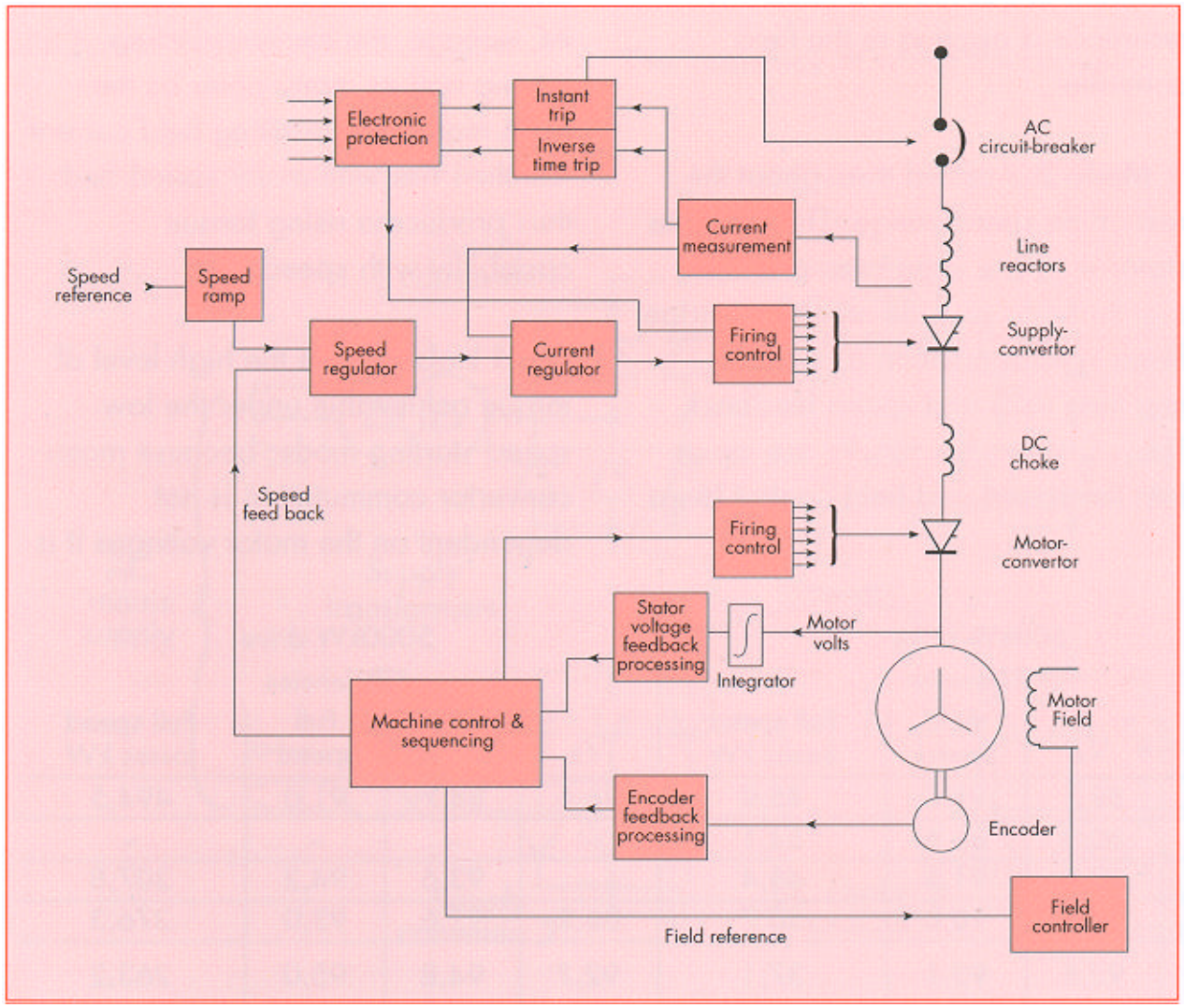
Control System Block Diagram



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Sigma Controller & Type C Power Interface Box

Sigma Controller

Type C Power Interface Board

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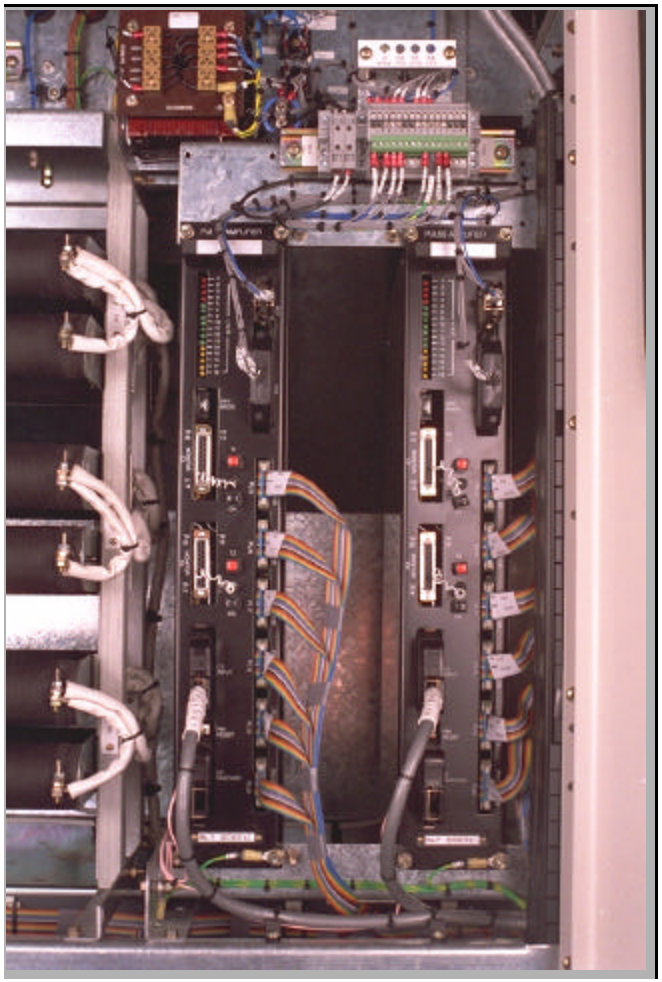
Pulse Amplifiers & M40 Gate Box

Pulse Amplifiers



M40 Gate Box

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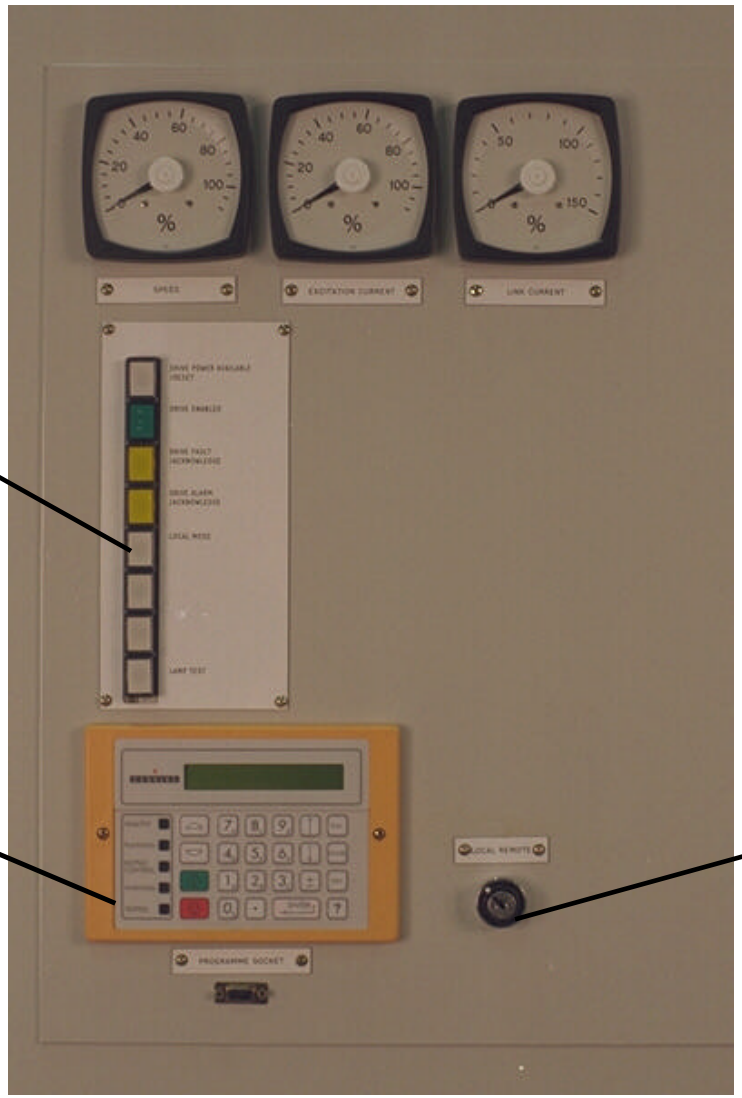
Regulator Controls



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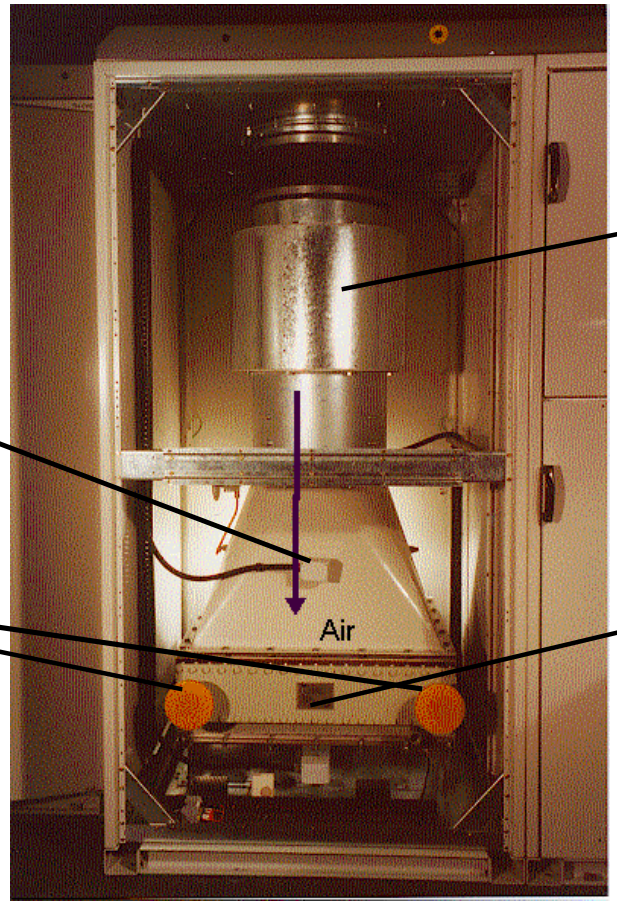
Cooler Cubicle



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Discoverer Enterprise Harmonic Filter

- 2 Harmonic Filters at 11kV Level
- Reduced in Size due to 12 Pulse
- 3500 KVAr
- 11kV, 3ph, 60 Hz
- 2 x LC Limbs,
- Tuned to 5th & 11th Harmonic