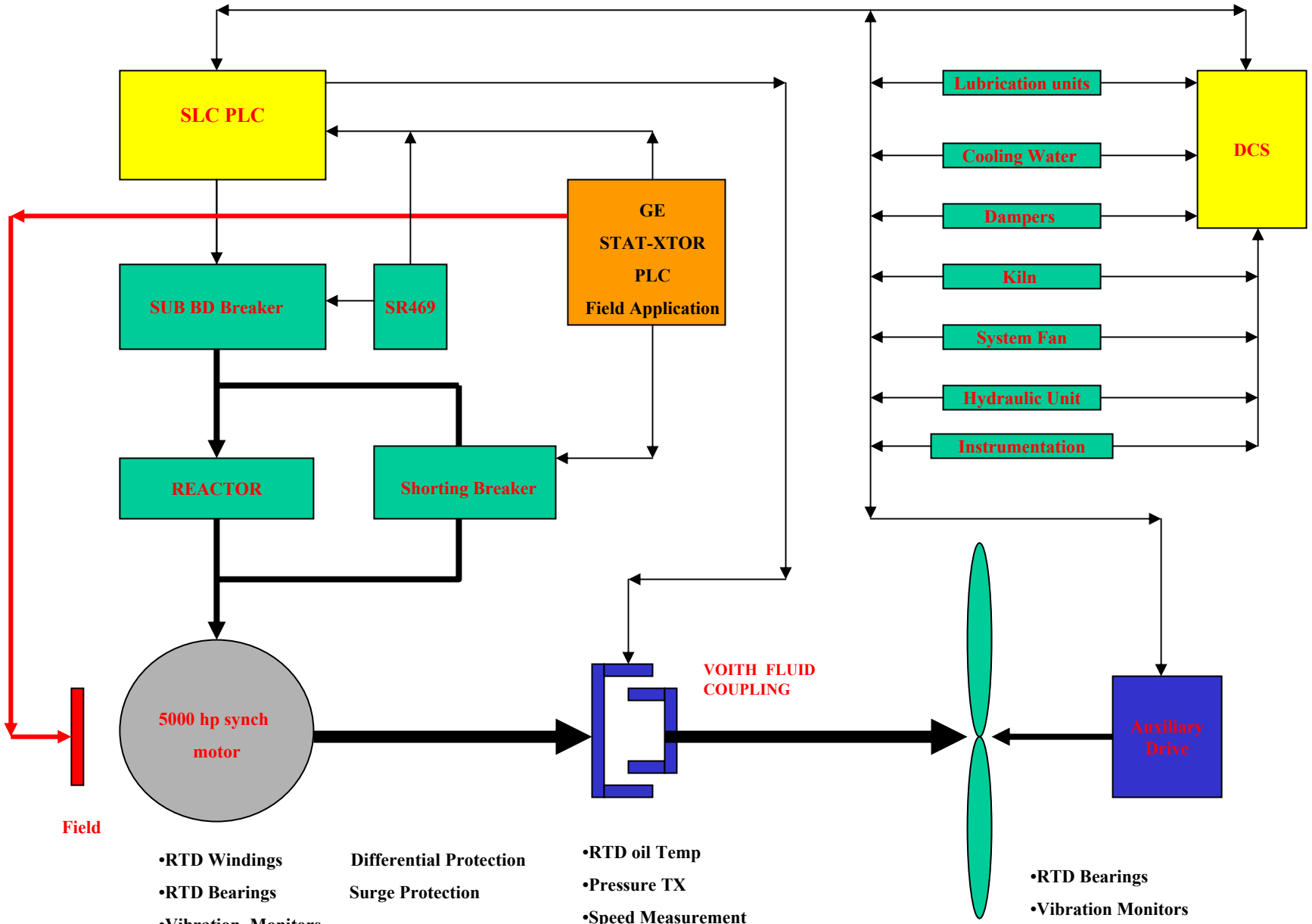


**Synchronous motor with fluid
coupling drive arrangement
for a preheater ID Fan**

presenter

Nathan Schachter

CIMENTEC Engineering Ltd



Field

- RTD Windings
- RTD Bearings
- Vibration Monitors
- Leak Detector
- Internal Air Temperature

Differential Protection
Surge Protection

- RTD oil Temp
- Pressure TX
- Speed Measurement

- RTD Bearings
- Vibration Monitors

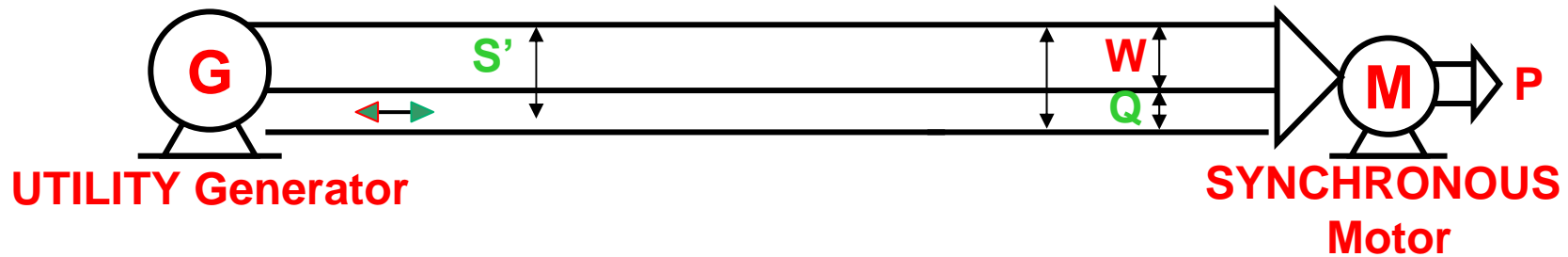
October 29, 2006

CIMENTEC Engineering Ltd

ROBINSON FAN

**SYNCHRONOUS MOTOR
VS
INDUCTION MOTOR**

POWER FACTOR CORRECTION USING SYNCHRONOUS MOTORS



Typical Power Flow in Motor Circuit

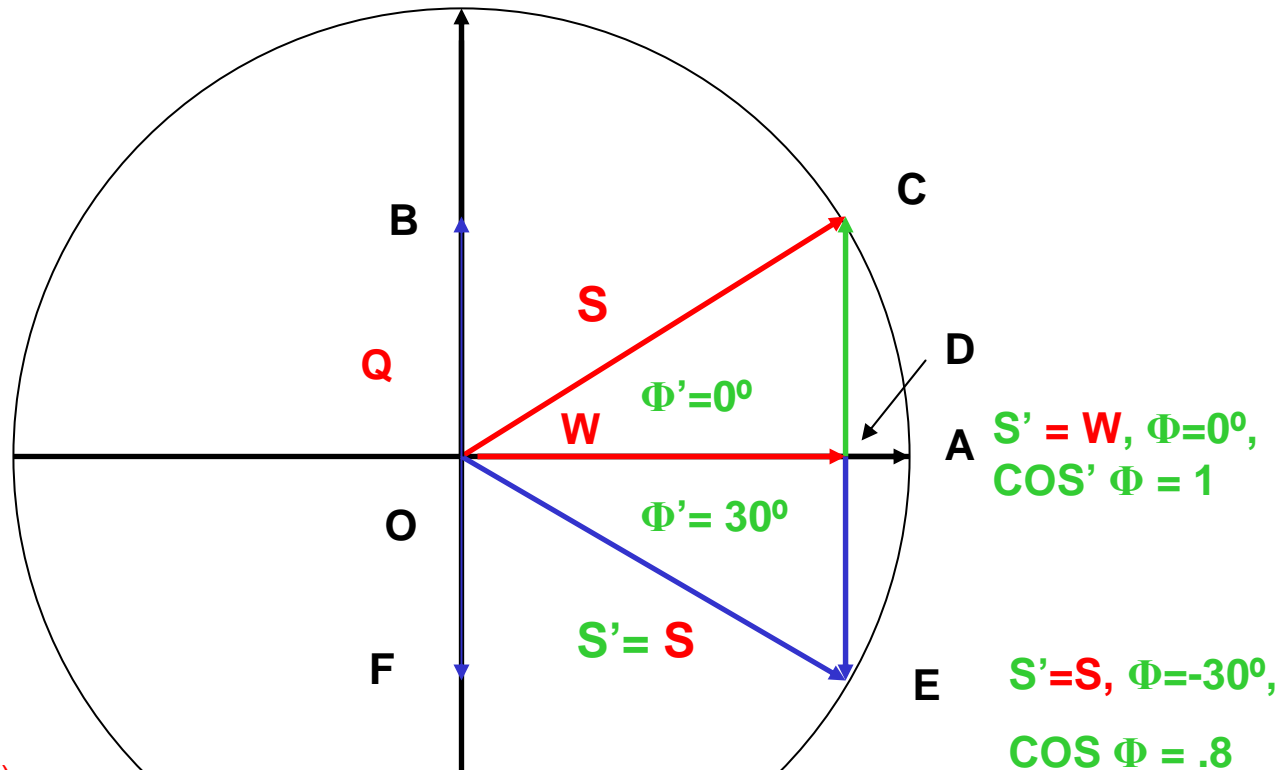
S: Apparent power kVA
Q: Reactive kVar

W: Active power kW
P: Mechanical power kW

Efficiency 3 - 4% Better than induction motors

Power Factor compensation with leading power factor

POWER FACTOR IMPROVEMENT USING SYNCHRONOUS MOTOR WITH UNITY or LEADING POWER FACTOR



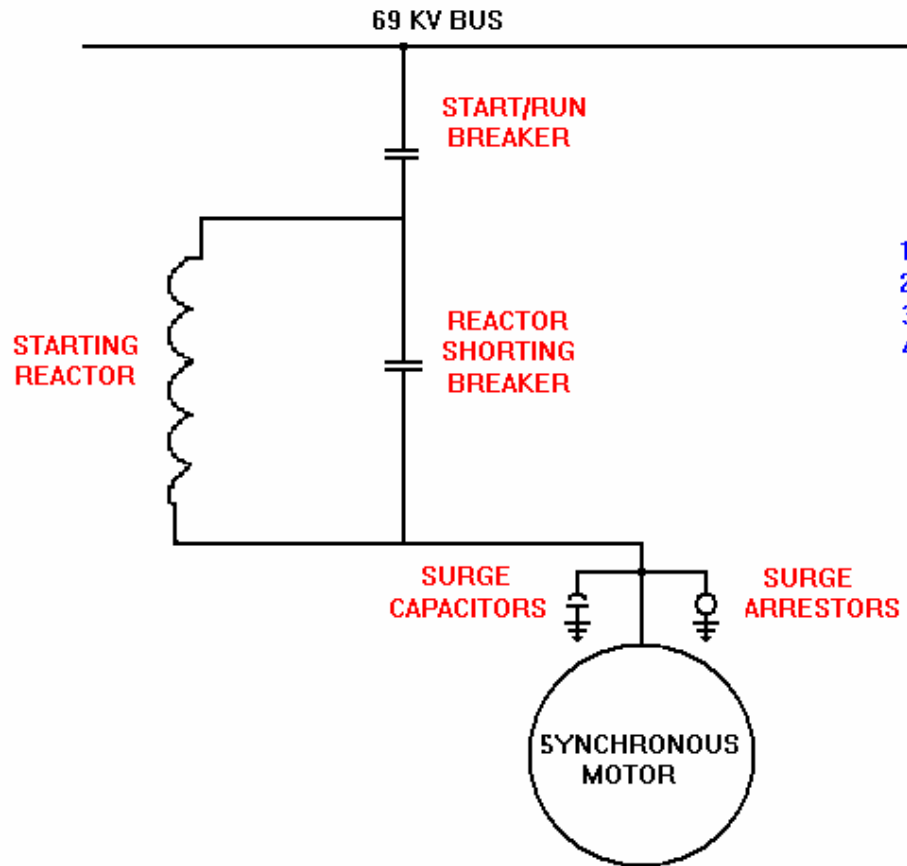
Vector Diagram

- OA: Active power W (kW)
- OB: Capacitive reactive power Q (kVar)
- OC: Apparent power S (kVA)
- OF: Inductive reactive power Q (kVar)
- CD: Reactive power compensation Q': (kVar) for unity PF
- Φ' : Phase angle compensated
- OD: New apparent power from utility S' at unity PF
- AE: Equivalent leading PF capacitor bank replaced = 25% of nameplate kVA of motor to compensate the balance of plant. Machine kVA $S' = S$.

TWO TYPES OF SYNCHRONOUS MOTORS EXCITERS

- ❖ Slip Ring
- ❖ Brushless Exciters

REACTOR START



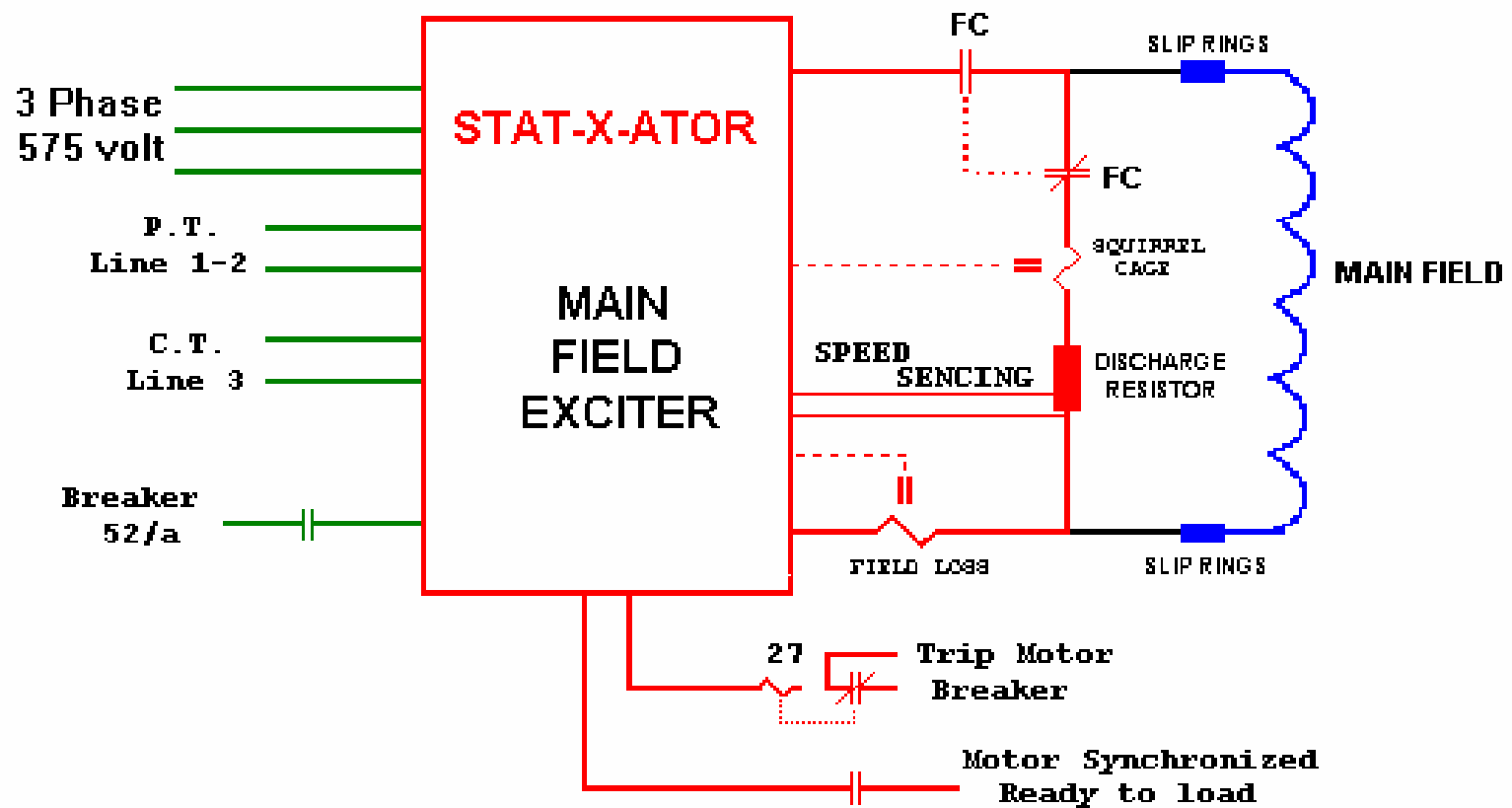
STARTING SEQUENCE

1. CLOSE START/RUN BREAKER
2. MOTOR ACCELERATES
3. AT 98% SPEED CLOSE REACTOR BREAKER
4. AFTER 2 SECONDS APPLY FIELD

BASIC OPERATION FOR ALL EXCITERS

- Close Breaker - Start Incomplete Sequence Timer
- Motor Accelerates
- At 98% Speed Apply Field
- 5 seconds after Applying Field, Arm Slip Guard Relay.
- 2 seconds after arming the Slip Guard Relay, energize MSC (Motor Synchronized, Ready to load), to give permission to load motor. This also resets the Incomplete Sequence Timer.

BASIC SLIP RING EXCITER



REVIEW OF SPECIAL OPERATION FUNCTIONS

- This motor is accelerated with a reactor in series with it.
- At 98% Motor Speed, the Starting Reactor is switched out. (The Reactor Breaker closed to short out the Reactor). The closing of the Reactor Breaker is controlled by the Stat-x-ator.
- Wait 2 seconds after the Starting Reactor is out before Field Application.
- On Normal Stop, open the reactor-shortening breaker when the Start/Run Breaker opens. The opening of the Reactor Breaker is controlled by the Stat-x-ator.

BASIC STAT-X-ATOR PROTECTION

ROTOR PROTECTION

- Field Proving Fault
- Main Field Thermal Overload (Trip)
- Hot Start Attempt (Trip)
- Squirrel Cage Overload (Trip)
- Slip Guard (Trip)
- Field Loss (Trip)
- Incomplete Sequence (Trip)
- Stall (Trip)
- Math OK (Trip)
- Fan Fail (Trip) Not always used
- High Field Resistance Fault (Trip)
- Low Field Resistance (Trip)
- Field Over Current (Trip)

- **REVIEW OF SPECIAL STAT-X-ATOR PROTECTION**
 - Shorting Breaker Failed to Close (Trip)
 - Shorting Breaker Failed to Open (Trip)
 - Shorting Breaker opened while synchronized (Trip)
- **BLOCK START SPECIALS**
 - Fault on the Stat-x-ator (“Green No Fault Lamp” is off)
 - Shorting Switch is still Closed
 - Hot Rotor (Block Start)
 - System Permissive via PLC

STATOR PROTECTION

MULTILIN SR469 microprocessor relay

- Short circuit
- Phase differential
- Overload
- Temperature –stator winding RTDs
- Over/under voltage
- Ground fault

REVIEW OF MOTOR MOUNTED COMPONENTS

- Slip Rings
- Leak Detector
- Water Cooling
- Bearing RTD
- Inlet Air RTD
- Stator RTD
- Surge Arrestors
- Surge Capacitors
- Differential CT
- Vibration Detector

REVIEW OF OIU FUNCTIONS

Operator interface unit

Key Pad Use
Event Log
Setting time

REVIEW OF THE EXCITER CONTROL CUBICLE (FIELD VISIT) VIEW OF COMPONENTS

- Power Bridge
- Control Card
- Crow Bar Assembly
- Watts/Var Transducer
- DCCT
- Voltage Transducer
- Shunt
- Meter Relay
- Ground Fault Detector
- 90/30 PLC
- OIU

END