



NETWORK STUDY AND MV TESTING PRESENTATION

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Equipment & Software

Test Equipment

Available In-house

- Doble 12 x voltage / current generators test set
- Tesient 6 x current / 4 x voltage generators test set
- VLF Test Set
- Micro Ohm Tester (Ductor)
- Touch and Step Potential Test Set (Metrel)
- Fluke Infrared Camera; TI200
- Fluke Power Quality Meter
- Cable Locator 2042T Fluke
- Multimeters
- Earth Resistance Tester
- Meggers
- Lux Level Meters
- General Tools



Specialised Software

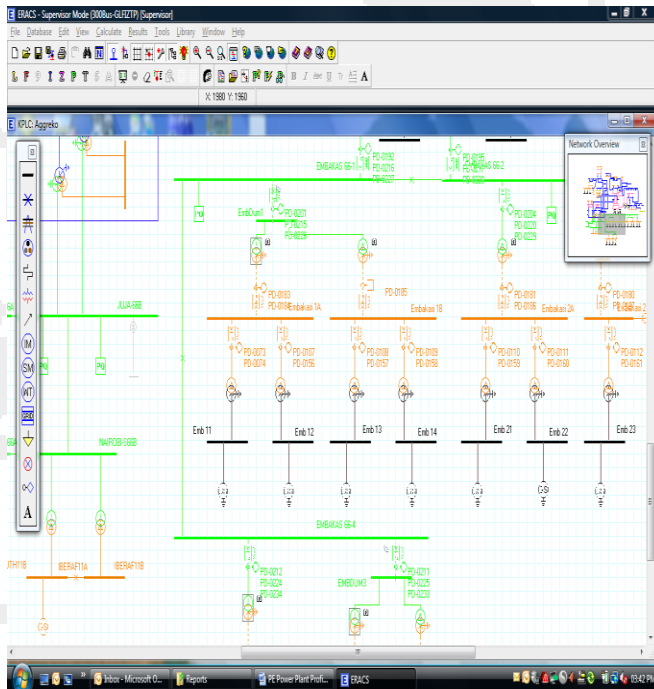
Computer Software

Available In-house

- ERACS (Network Studies)
- ePlan (Electrical CAD)
- AcSELerator Relay Setup
- Micom S1 Studio
- PCM 600 (ABB Relay Setup)
- AutoCad
- Siemens PLC & Simocode Software
- Mitshubishi PLC Software
- Relux Lighting

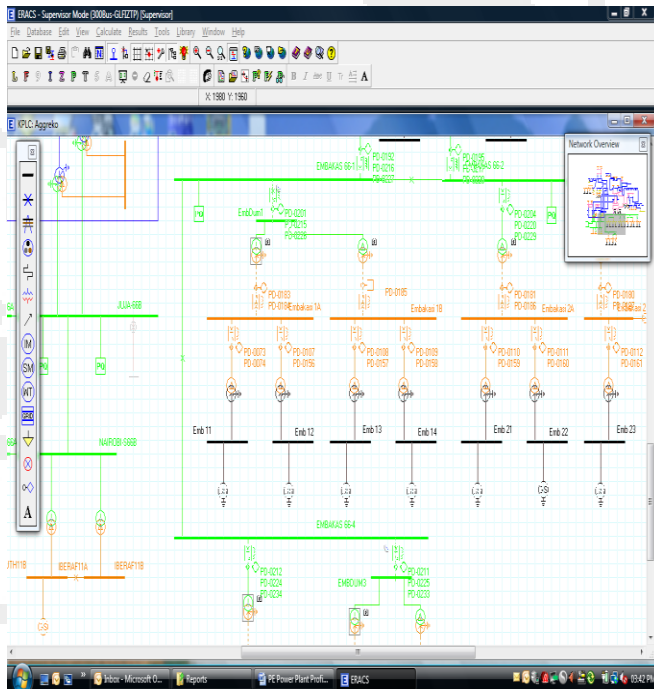


Furnace Network Studies



- ACL Metais DC Furnace – Brazil
- Anglo Waterfall Smelter – SA
- ASA Metals Chrome Furnace – SA
- Hernic Furnace Complex – SA
- TC Smelters – SA
- Samancor Chrome Furnace – SA
- Xstrata Lion Smelter – SA
- Xstrata Boshhoek Smelter – SA
- Sakura Furnaces (Assmang) - Malaysia

Other Network Studies



- Aggreko International 2010 SWC - SA
- Aggreko International 2014 SWC - Brazil
- Kalagadi Mine – SA
- Kenya Grid Collapse Study – Kenya
- Kongoni Mine – SA
- Mozambique Grid Network Study – Mozambique
- Zangesour Protection Grading – Armenia
- Kashen Mill Network Study – Armenia
- Teghout Mill Network Study – Armenia
- Olympics 2016 - Brazil



What we need for the studies

- Fault levels at nearest grid substation and harmonic contents if available
- Complete Single Line Diagram of Facility
- Cable Size, Length, Type, Environment, voltage rating
- Load kW, Voltage, power factor, type
- Transformer, impedance, vector group, tap changer information (auto / manual) steps
- Overhead line – spacing, type of tower, length, conductor type, voltage rating
- Motor details, inertia, kW, power factor, etc
- Capacitor bank details, rating MVar, Voltage, etc.

ASSUMPTIONS CAN BE MADE FROM EXPERIENCE FOR INFORMATION NOT YET AVAILABLE or WE WILL MAKE RECOMMENDATIONS



Load Flow Studies

- Entire Plant is Simulated on ERACS software
- Construct a model of all electrical equipment
- Following typical details form part
 - Cable Size, Length, Type, Environment, voltage rating
 - Load kW, Voltage, power factor, type
 - Transformer, impedance, vector group, tap changer information (auto / manual) steps
 - Overhead line – spacing, type of tower, length, conductor type, voltage rating
 - Motor details, inertia, kW, power factor, etc
 - Capacitor bank details, rating MVar, Voltage, etc.



Load Flow Results

- Selection of transformer tap changer settings
- System voltage profiling
- System loss optimisation
- MW and MVar power flow analysis
- Equipment loading factors
- Power factor correction location and optimisation

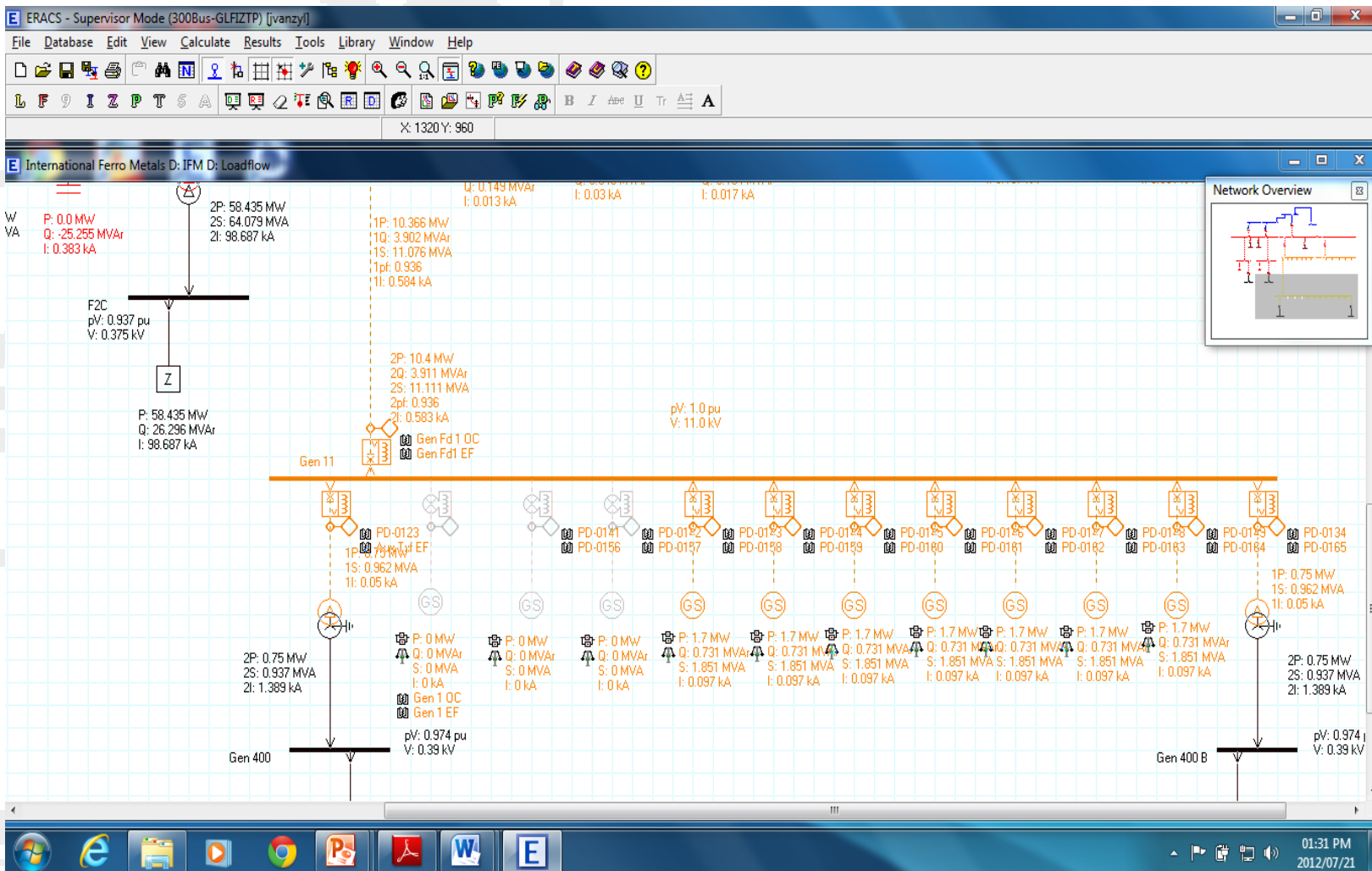


Load Flow Results

- This information could in the future be used for
 - system planning
 - generator operating procedures
 - equipment specification
 - impact load studies
 - circuit reconfiguration studies
 - power generation planning



Load Flow Studies



Fault Studies

- The following Faults are all simulated with different configurations of the network
 - Single Phase to Earth Fault
 - Phase to Phase Fault
 - 3 Phase Fault
 - 2 Phase to Earth Fault



Fault Studies Results

- Calculation of data for circuit breaker and switchgear ratings (maximum and minimum 3 phase fault currents)
- Calculation of data for relay and fuse selection and setting
- Calculation of motor fault contribution (this is virtually impossible to do manually)
- Determination of fault current distribution and busbar-voltage levels during a fault



Fault



Protection Grading Studies

- Enter the CT ratios into the model
- Enter the Protection devices details
- Make the curve selection
- Require the upstream protection settings

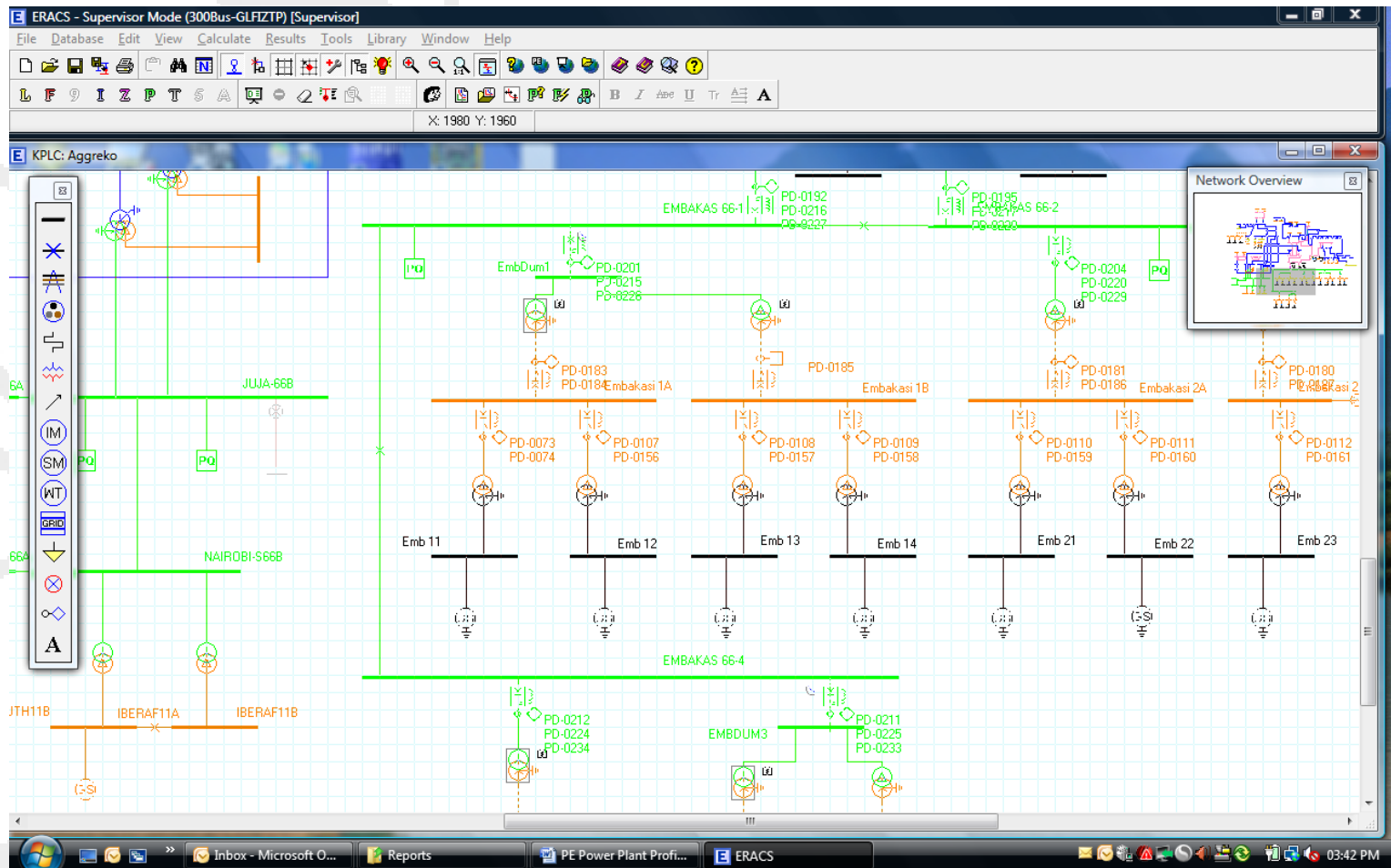


Protection Grading Studies

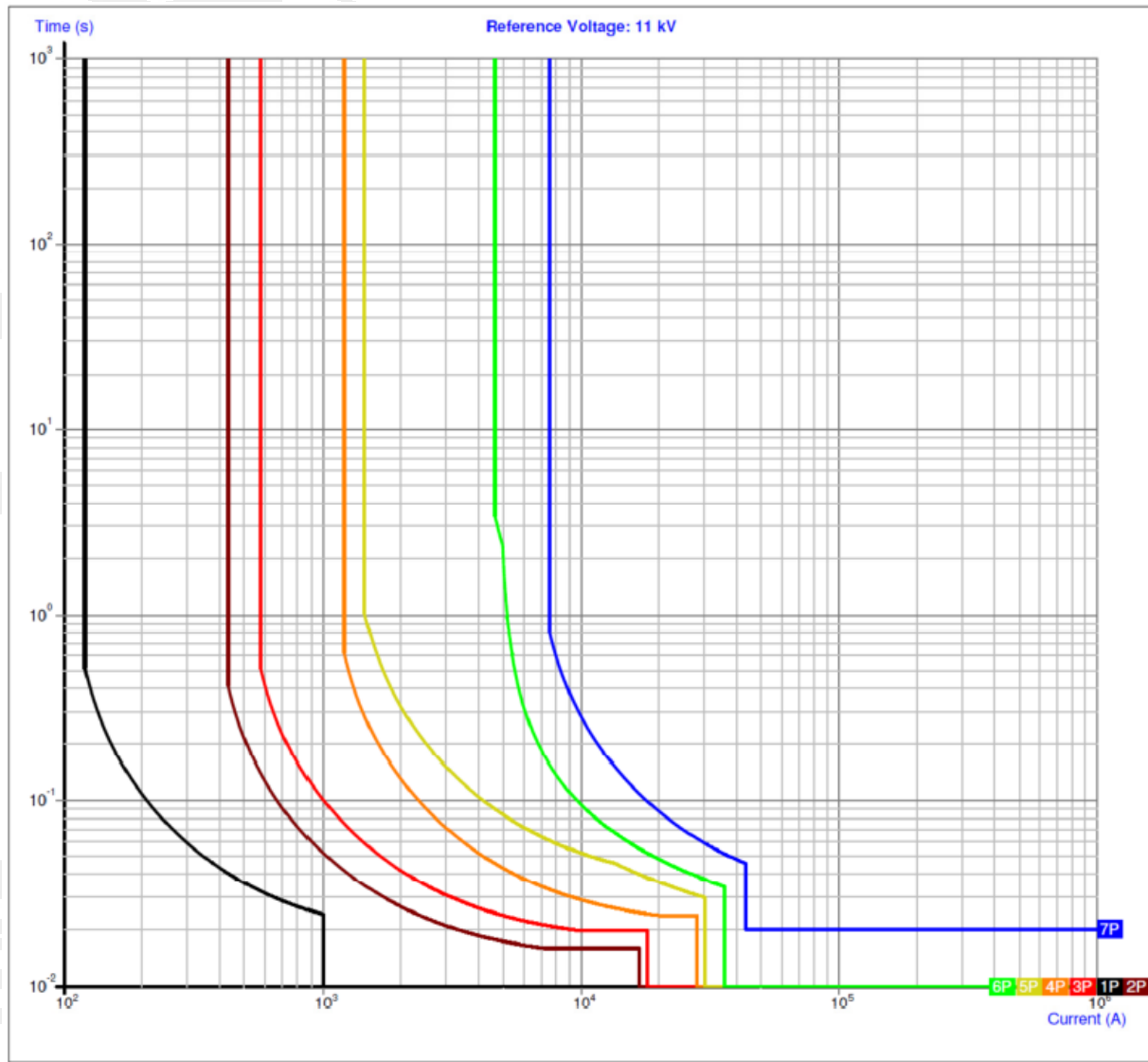
- Selection of protection devices
- Protection stability studies (under steady state conditions)
- Protection planning philosophy and performance checking
- Protection system safety documentation



Protection Grading Studies



Protection Grading Studies

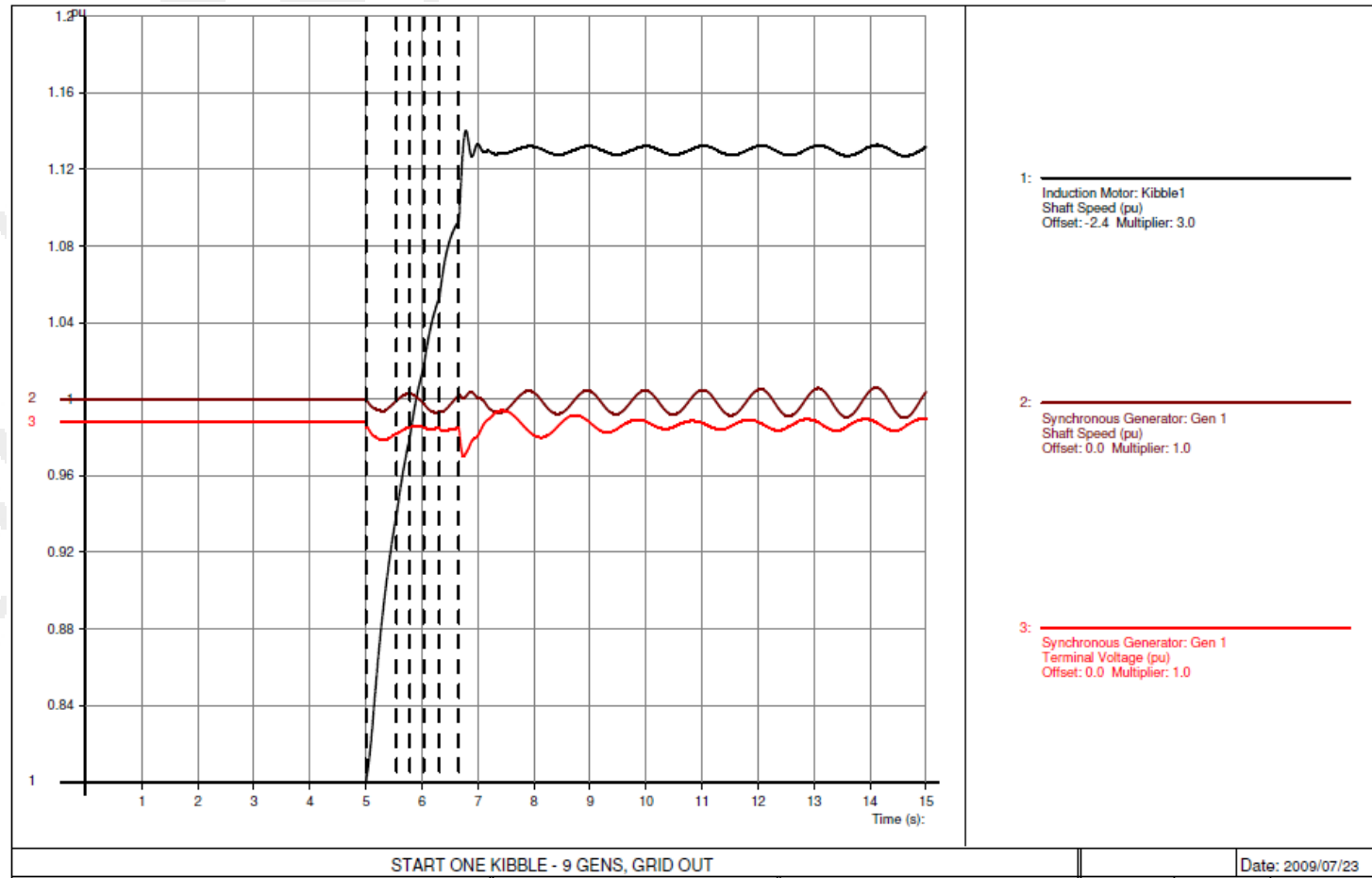


Motor Starting Studies

- Simulate the network behaviour when starting large motors
- Add the motor load details
- Type of starting (DOL, Star / Delta, VSD, Liquid Strater, etc.)
- This will provide assurance that large motors can be started on the network



Motor Starting Studies



Harmonics

- IEEE 519 – Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems Section 10 will be used as the baseline.
- This is also in line with the Grid Code requirements.
- Client to supply current harmonic levels as measured at Substation.
- We need this to accurately simulate the Harmonics of the overall system



Arc Flash Studies

- The **Arc Flash Risk Assessment module** enables the engineer to analyse arc flash hazards for electrical networks modelled in ERACS. This module is based upon:
 - § ***IEEE Std 1584-2002: IEEE Guide for Performing Arc-Flash Hazard Calculations***
 - § ***IEEE Std 1584a-2004: IEEE Guide for Performing Arc-Flash Hazard Calculations - Amendment 1*** which details amendments to clauses 5 and 7 of *IEEE Std 1584-2002*
 - § ***IEEE Std 1584b-2011: IEEE Guide for Performing Arc-Flash Hazard Calculations - Amendment 2*** which details amendments to clause 4 of *IEEE Std 1584-2002*
 - § ***NFPA 70E-2012: Standard for Electrical Safety In the Workplace***
 - § ***NFPA 70E-2015: Standard for Electrical Safety In the Workplace***



Arc Flash Stickers

		WARNING	
ARC FLASH AND SHOCK HAZARD APPROPRIATE PPE REQUIRED			
		Date of Analysis: 2017/01/13	
Arc Flash Boundary at 5.0 J/cm ² (1.2 cal/cm ²)		9 m	
Incident Energy at 910 mm Working Distance		115.2 cal/cm ²	
Shock Hazard		33 kV	
Bolted Fault Current		10.653 kA	
Equipment ID : 33kVS Bus A			

Produced on ERACS software from
Edit ERA



Relay Setup

- SEL
- ABB
- MICOM
- Siemens
- Old electromechanical relays
- Strike
- Schneider
- GE Multilin



MV Testing

- Primary Current Injection testing up to 2500 Amp (Single Phase)
- Secondary Current Injection Testing up to 12 phases
- Complete relay testing
 - Over/under current
 - Over/under voltage
 - Synchronising
 - Synch Check
 - Differential



MV Testing

- VLF Cable Testing
- Touch and Step potential testing (full earth system)
- Circuit Breaker Testing
- Transformer Testing



Clients

- Aggreko International
- Anglo Coal Technical Services
- ASA Metals
- Bridgestone
- Environmental & Process Solutions
- Hernic
- International Ferro Metals
- Kellogg, Brown & Root International Inc
- Metix
- Pangaea
- PG Bison



Clients

- Shaft Sinkers
- Transalloys
- Transwerk
- Wispeco Aluminium
- Xstrata / Glencore
- Samancor
- Richards Bay Alloys
- FL Smidth
- Assmang
- Kalagadi



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THANK YOU

