APPENDICES

Appendix 1

The Process Flow diagram of Lloyds Steel plant:
The plant is divided into three major sections:
1. SMS (Steel Melting Shop)
2. HRM (Hot Rolling Mill)
3. CRM (Cold Rolling Mill)
**Power Distribution System**

- **MSEB, 220kV Incomer – Main Power I/C**
  1. MSEB 220 kV I/C –1, 198kV LA, 400/1 P-CT, GOS-1, GOS-5, 200VA PT, 300/1 CT, 2000A, 25kA, SF6, 198kV LA, TR-1.
  2. MSEB 220 kV I/C –2, 198kV LA, 400/1 P-CT, GOS-4 (O/G to GOS-3 & 7), GOS-7, 200VA PT, 300/1 CT, 2000A, 25kA, SF6, 198kV LA, TR-3
  4. EB Metering Cubicle – Common to EB I/C-1 & 2.

- **33kV TR-1, Sec – 1, 63/80 MVA, 220/34.5kV, EMCO,**
  1. TR-1, 2500A VCB, 12.5%, Ynd1, 220kV – OHL, 33kV Cable – 7Rx 300 mm² – 80mtr.
  2. 13.45 MVAR, 48kV, 11th Harmonic Filter, ABB/PS-Elect.
  3. **HRM SECTION**
    1. Roughing Mill (RM), TR–RM, 4.36 MVA, 33/ 780 – 780, Dyn11/ Dd0, CG, 33kV Cable – 1Rx 300mm² – 500mtr, DC Motors, GEC, Top / Bottom each 3500 hp (Typically 13, 000 Units PD).
    2. Finishing Mill (FM), TR–FM, 5.42 MVA, 33/ 745 – 745, Dyn11/ Dd0, CG, 33kV Cable – 1Rx 300 mm² – 700mtr, DC Motors, Westinghouse, Top / Bottom each 4500 hp (Typically 50, 000 Units PD).
    3. TR-HRM-1 (in parallel TR-HRM-2), 12.5/16MVA, 33/11kV, Dyn11, 33kV Cable – 2Rx 300 mm² – 500mtr., 11kV Cable – 4Rx 300 mm² – 35mtr (75,000 Units PD)
      1. 1000KVA, ThyristorTrs, Flying Shear (40 units PD)
      2. 1270KVA, ThyristorTrs, Width Edger Press (400 units PD)
      3. 1360KVA, ThyristorTrs, (2x 680KVA Sec.) Pinch Roll (100 units PD)
      4. 400KVA ThyristorTrs, Down Coiler (500 Units PD)
      5. 13.5KV, 1800KVAr, Capacitor
      6. Rest all AC & Aux Loads
4. TR-HRM-2 (in parallel TR-HRM-1), 12.5/16MVA, 33/11kV, Dyn11, 33kV Cable – 2Rx 300 mm² – 500mtr, 11kV Cable – 4Rx 300 mm² – 35mtr (75,000 Units PD)
1. 1270KVA, ThyristorTrs, Drum Drive Entry (1200 units PD). TRS heating and occasional failure (twice in 10 years).
3. 13.5KV, 1800KVAr, Capacitor
4. Rest all AC & Aux Loads

4. CRM SECTION
1. TR-CRM-1, 8/10MVA, 33/11kV, Dyn11, 33kV Cable – 1Rx 300 mm² – 300mtr + 800mtr OHL, 11kV Cable – 4Rx 185 mm² – 60mtr (Typically 75, 000 Units PD)
   1. TR-CRM, Mill-1, Top/Bottom, 3.7MVA, CG, 11/ 750 – 750, Dd0y11, 2nos. 1200kW DC Motors one each. (Typically 16,000 Units PD)
   2. TR-CRM, Mill-1, Reel- Entry/Exit, 3.7MVA, CG, 11/ 750 – 750, Dd0y11, 2nos. 370kW DC Motors (coupled) for each, totaling four. (Typically 3,200 units PD)
   3. 12.6KV, 3.75MVAr, 6% Reactor & Capacitor
   4. Cont Galvanizing Line (CGL), AC Motors.
   5. Pickling Line, AC Motors.
   6. Rest all AC & Aux Loads.

2. TR-CRM-2, 8/10MVA, 33/11kV, Dyn11, 33kV Cable – 1Rx 300 mm² – 300mtr + 800mtr OHL, 11kV Cable – 4Rx 185 mm² – 60mtr. (Typically 50, 000 Units PD)
   1. TR-CRM, MILL-2, Top, 3MVA, 11/ 750 – 750, Dd0y11, 2 nos. 937.5 kW (coupled). DC Motors.
   2. TR-CRM, MILL-2, Bottom, 3MVA, 11/ 750 – 750, Dd0y11, 2 nos. 937.5 kW (coupled). DC Motors.
   3. TR-CRM, MILL-2, Delivery, 3MVA, 11/ 750 – 750, Dd0y11, 2 nos. 850 kW (coupled). DC Motors.
   4. TR-CRM, MILL-2, Entry, 3MVA, 11/ 750 – 750, Dd0y11, 2 nos. 850 kW (coupled). DC Motors.
5. 12.6KV, 3.75MVAR, 6% Reactor & Capacitor
6. Rest all AC & Aux Loads
5. Rest AC & Aux Loads like Colony, O2 Plant etc.

- 33kV TR-2, Sec – 2, 63/80 MVA, 220/34.5kV, NGEF
  1. TR-2, 2500A VCB, 12.5%, Ynd1, 220kV – OHL, 33kV Cable – 7Rx 300 mm² – 60mtr.
  2. 15.22 MVAR, 48kV, 3\textsuperscript{rd} Harmonic Filter, ABB/PS-Elect.
  3. 6.32 MVAR, 48kV, 4\textsuperscript{th} Harmonic Filter, ABB/PS-Elect.
  4. EAF-1 (MDH, Germany, 50T, running load 60T), 40MVA, 33kV /545-407-150V, Tamini
  5. LHF-1 (MDH, Germany, 50T, running load 60T), 10MVA, 33kV /261-110V, Tamini

- 33kV TR-3, Sec – 3, 63/80 MVA, 220/34.5kV, NGEF
  6. TR-3, 2500A VCB, 12.5%, Ynd1, 220kV – OHL, 33kV Cable – 7Rx 300 mm² – 60mtr.
  7. 15.22 MVAR, 48kV, 3\textsuperscript{rd} Harmonic Filter, ABB/PS-Elect.
  8. 6.32 MVAR, 48kV, 4\textsuperscript{th} Harmonic Filter, ABB/PS-Elect.
  9. 27.00 MVAR, 47.25kV, 6%-reactor, Capacitor Bank, ABB/WHV
  10. EAF-2 (INDO MAG, India 50T, running load 60T), 40MVA, 33kV /545-407-150V, CG
  11. LHF-2 (INDO MAG, India 50T, running load 60T), 10MVA, 33kV /261-110V, CG
Photograph 1: Arc Furnace
Photograph 2: Power Quality Analyser, Candura make.
Photograph 3: Set up at Rolling Mill Bus
Photograph 4: 220 kV Substation Set Up for Recording and Analysis
Photograph 5: Control Room Staff at Lloyd Steel Plant