1 GENERAL

1.1 Purpose

The purpose of this document is to provide short circuit calculations based on IEC 60909 and analysis for the electrical power system.

1.2 Scope

The scope of the calculations covered by the document is as follows:

- Symmetrical short circuit currents (I_b)
- Initial symmetrical short circuit current (rms) (I_k")
- Peak short circuit current (i_p)

1.3 Responsibility

Any updates/revisions of this document will be the responsibility of the Engineering or Commissioning Team.

Any deviations from this procedure will have to be documented.

In case of major changes in the work described in this procedure (e.g. reduced scope of operating tests to be performed), a revision of the procedure is required.

1.4 Filing / Retrieval

The official versions of this procedure will at all times be the updated version stored at Document Control.

Prior to any work starting on this procedure, the responsible party will ensure that the print-out copy available at site has the latest revision number and contains the latest updated information.

As the work proceeds, for each step of the job that has been performed, the package responsible engineer or his/her delegate and the Client representative will verify by signature that the work has been completed.

2 INTRODUCTION

The short circuit calculations contained in this document are to be used to determine thermal and mechanical stress seen by the electrical equipment. The thermal and mechanical stresses are then used to size equipment and determine power component withstand capabilities.

Power Tools for Windows (PTW) was used to calculate the system short circuit currents for this project. PTW assumes the following:

- All system capacitances are ignored
- Short circuit impedance is ignored
- The short circuit occurs in all three phases simultaneously (three phase fault)
- Unmeshed system

2.1 Abbreviations and Nomenclature

Abbreviation	Meaning
BUS-MAIN	600V Main Bus
BUS-MCC	480V MCC Bus
BUS-DIST	208V Distribution Bus
I_k"	Initial symmetrical short circuit current (rms)
I_k	Steady-state short circuit current (rms)
i_p	Peak short circuit current
I_b	Symmetrical short circuit breaking current (rms) voltage
PTW	Power Tools for Windows (SKM) computer software
rms	Root Mean Square
ms	Millisecond

3 SINGLE LINE DIAGRAMS

The Single-Line Diagrams are too large to print in a report format and still be readable. See Appendix A for the full-size drawings.

4 INPUT DATA

This section summarizes the main component input data for quick reference.

4.1 Generator Input Data

The system has (4) main engine-generator sets (each rated 1950kVA, 600VAC, 60Hz) running at 1200rpm. All of the generators were modelled as swing. Table 4-1 displays the input data.

Table 4-1: Generator input data

Component	Rated (kVA)	Power Factor	Rated (V)	X"d (pu)	X"q (pu)	X0 (pu)	Xd (pu)	X'd (pu)
GEN1	1950	0.7	600	0.221	0.131	0.008	0.171	0.274
GEN2	1950	0.7	600	0.221	0.131	0.008	0.171	0.274
GEN3	1950	0.7	600	0.221	0.131	0.008	0.171	0.274
GEN4	1950	0.7	600	0.221	0.131	0.008	0.171	0.274

4.2 Transformer Input Data

The system has (1) 600:480VAC, 1000 kVA rated MCC transformer, and (1) 600:208/120VAC, (1)112.5 kVA rated distribution transformer. Table 4-2 displays the input data.

Table 4-2: Transformer input data

Component	Connection Type	Nominal (kVA)	Pri Rated (V)	Sec Rated (V)	X/R	Xpos (%)	Xzero (%)	Z% (%)
MCC XFMER	Delta/Delta	1000	600	480	5.7112	1.06	5.56	5.75
DIST XFMER	Delta/Wye	112.5	600	208/120	3.3938	1.41	4.79	5.00

4.3 Motor Input Data

To simulate the MCC and other motor loads, a single equivalent motor or load was used for each respectively. The value for the equivalent load is determined by the scenarios defined in section 6.

4.4 Cable Input Data

All power cables were modelled in PTW according to estimated lengths.

5 EQUIPMENT RATINGS

5.1 600VAC Main Bus Bar

The 600VAC main bus bar is designed to withstand 100kA rms short circuit current.

5.2 480VAC MCC and 208/120 VAC Distribution Panel Bus Bar

The 480VAC MCC bus bar is designed to withstand 42kA rms short circuit current. The 208/120 VAC distribution panel bus bar is designed to withstand 10kA rms short circuit current.

5.3 Protective Devices

The protective devices are ABB circuit breakers. Ratings of these devices are listed in table 5-1 below.

Table 5-1: Protective device data

Consumers	Model	Line Voltage (VAC)	Rating	Sym. Amps I.C.
Gen1-4	ABB E3S-A	600	2000 AF	75 kA
SCR SW1-4	ABB E3S-A	600	1600 AF	75 kA
FDR 3	ABB E3S-A	690	1600 AF	75 kA
FDR 1	ABB T4V	600	150 AF	100 kA
FDR 2	ABB E3S-A	690	1250 AF	75 kA