



**Project #719**  
**(Theme Park 1)**  
**项目 719**  
**(主题公园 1)**

**Short Circuit Calculation and Study**  
**短路计算报告**

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**WorleyParsons**  
resources & energy



## SYNOPSIS

This document presents Short Circuit Calculation and Study for the **Package 1 – BOH 718, Park Wide 719 and Resort Wide 760 of Beijing Resort Project.**

本文件是工作包 1 的短路计算报告，包含主题公园 719、后勤区和休闲区。

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PROJECT IE1511D1253 –SHORT CIRCUIT CALCULATION AND STUDY							
REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
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## **1 INTRODUCTION**

### **1.1 Power System Description**

The new main 10kv substation will be located on north-side of TP1. The purposed power system will distribute feeds from 10 kV main substation to pad mounted switchgear stations near the secondary loop in TP1 and BOH area. Each pad mounted switchgear station has two (2) utility feeders for redundancy. And the 10 kV compact substations located in different lands will be supplied from the pad mounted switchgear through two (2) feeders.

### **1.2 Scope**

This document covers short circuit calculation and study through ETAP (Ver. 14.0.0C) for the Electrical Power and Distribution system of UBR.

The purpose of the short circuit study is to calculate the maximum fault current that can exist on each of the high and low-voltage buses in the electrical distribution system. The calculated values of short-circuit currents are used to select switchgear bus bar and component short circuit rating.



## 2 CODES AND STANDARDS

### 2.1 General

The Electrical design and documentation shall be in accordance with the requirements of following codes, standards, regulations and Project documents

### 2.2 Regulations

Where Chinese regulations exist, the requirements of these shall apply.

### 2.3 Codes and Standards

The requirements of the latest editions of the following codes and standards shall be complied with:

IEC 60909	Short Circuit Calculation in Three-Phase AC System
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Any conflicts between the standards, strict requirements shall apply to this project and align with Universal discipline engineers.

### 2.4 Abbreviations

DOL	Direct On Line
ETAP	Electrical Transient Analyzer Program
IEC	International Electro Technical Commission
IEEE	Institute of Electrical and Electronic Engineers
AC, ac	Alternating Current
HV	High Voltage, taken as being above 1000V
LV	Low Voltage, below 1000V
kW	kilo Watt
kVA	kilo Volt Ampere
MVA	mega Volt Ampere
SC	Short Circuit

### **3 INPUT DATA**

Power system components data is taken from the reference discipline or standard ETAP libraries. The loads are assumed where the input from other package is lacking, and will be updated when they are available.

#### **3.1 Power Grid Data**

The estimated short circuit rating of supply bus of upstream Power Bureau is 31.5 kA, rated at 10kV, X/R is 10. The cable length from the Power Bureau to the 10kV TP1 main substation is estimated to 2000 meters.

#### **3.2 Transformer Data**

The input parameters of transformers are as per the overall single line diagram – TP1&BOH (drawing No. 719-970-101-E-001/E-002).

#### **3.3 Cable Data**

Cables are modelled as per power plan drawings, and impedance values for cables are obtained from the standard ETAP libraries.

#### **3.4 Motor Data**

All motors are assumed to be induction motors type and are modelled as per specification for motor and standard ETAP libraries.

## 4 SHORT CIRCUIT CALCULATION

Calculation of short circuit current under three phase balanced condition is based on IEC 60909. Maximum short circuit current is used to determine the allowable fault ratings of equipment.

The value of maximum short circuit current which is the worst result of all case should be calculated. The most critical case is selected for the short circuit study as follow:

- The 10 kV and 0.38 kV systems of distribution substation are configured as two incoming breakers are closed, the bus-tie breaker is opened. Only one 10 kV pad mounted switchgear is operating in a closed tie breaker and one of the incoming breakers is closed.
- All continuous motors and intermittent motors are running, standby motors are stopped.

The analysis included the following.

- Consider all motors start by direct on line only.
- Voltage factors (c factors) are applied as per the requirements of IEC 60909. The value of 10kV is 1.07 and 0.38kV is 1.05.

Symbols table is from IEC 60909:

Parameter	Description
$I''_k$	Initial Symmetrical Short-Circuit Current
$i_p$	Peak Short-Circuit Current
$I_k$	Steady-State Short-Circuit Current
$I_b$	Symmetrical Short-Circuit Breaking Current



## 5 RESULTS

The calculated maximum fault currents of MV and LV system are as follows:

**Table-1: Max. Bus Fault Level**

Fault Location	Nominal Voltage	Calculated Fault Levels		
		Three Phase I" <sub>k</sub>	Line to Line to Ground I" <sub>k</sub>	Single Line to Ground I" <sub>k</sub>
	kV	3P	L-L-G	SLG
Energy Station MV Bus 1, 2	10	20.3 kA	17.6 kA	0 kA
714-T07 LV Bus, 714-T06 LV Bus	0.38	37.3 kA	36.9 kA	35.3 kA

Refer to Attachment UBR Fault Level Summary for details of MV and LV switchgear buses.





## **6 ATTACHMENT**

- UBR Overall Single Line
- UBR Fault Level Summary