

## **CHAPTER 4**

# **PROTECTION REQUIREMENTS**

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### PROTECTION REQUIREMENTS

#### 4.1 General

Means of protection for automatic disconnection against phase and earth faults shall be provided on the customer main switch. The type and setting of protective devices shall be so selected that they can grade properly with the Company infeed protection.

The customer shall provide Time-Current curve showing that the proposed protection scheme for the main switch can grade properly with HEC system under both phase fault and earth fault conditions.

#### 4.2 Customer 11kV Main Switch

Anticipated maximum 11kV fault level:-

Phase fault: 18.4kA (350MVA)

Earth fault: 2.0kA

To grade with HEC 11kV feeder protection, the protective relays of customer 11kV main switch shall have an operating time not exceeding the maximum allowable time-current curves for phase fault and earth fault as shown in Drg. Nos. GCS/4/01 and 02 respectively.

Protection C.T.s shall have adequate output to prevent C.T. saturation. The customer shall provide document/calculation sheet to show that the proposed C.T.s have adequate output for the application under both phase and earth fault conditions.

#### 4.3 Customer LV Main Switch

1. The overcurrent protection of customer LV main switch shall grade with the Company's transformer 11kV protection and has an operating time not exceeding the maximum allowable time-current curves for various ratings of LV main switches as shown in Drg. No. GCS/4/03.
2. The customer protective devices shall be set so that disconnection is achieved within 5 seconds during an earth fault.

### 3. Bonding Between HEC and Customer's Earthing Systems

- a. Under the current regulations, the customer's earthing system shall be bonded to that of the HEC's earthing system for transformer supplies. This will cause a significant increase in LV earth fault current, the magnitude of which can be as high as phase fault current.
- b. If the customer LV overcurrent and earth fault protections share the same set of C.T.s, high output C.T.s and low burden type earth fault relay shall be used to prevent C.T. saturation. The customer shall provide document/calculation sheet to show that the proposed protection C.T.s have adequate output for the application under earth fault condition.
- c. As an alternative to the use of high output C.T.s and low burden type earth fault relays, separate sets of C.T.s can be used for overcurrent and earth fault protections as shown in Drg. No. GCS/4/04.

#### 4.4 **Protection Scheme For Main Switch**

The customer is advised to provide a summary sheet as shown in Drg. No. GCS/4/05 and GCS/4/06 for LV and HV main switch protection scheme respectively to HEC for consideration.

#### 4.5 **Schedule of Drawings - Protection Requirements**

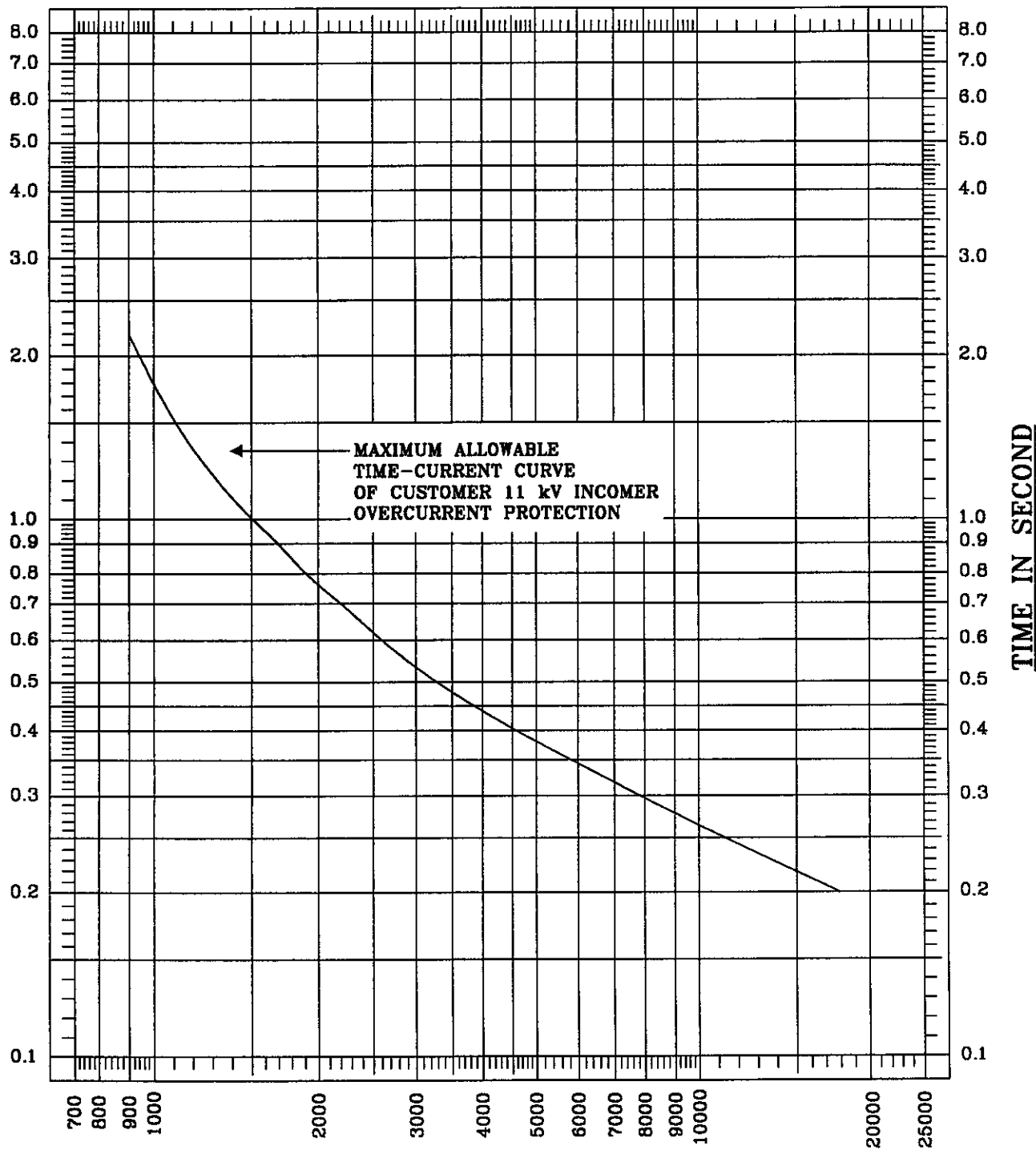
<u>Drawing No.</u>	<u>Drawing Title</u>
GCS/4/01	Maximum Allowable Time - Current Curve of Overcurrent Protection at Customer 11kV Main Switch (PC/835/02/60/0576).
GCS/4/02	Maximum Allowable Time - Current Curve of Earth Fault Protection at Customer 11kV Main Switch (PC/835/02/60/0577).
GCS/4/03	Maximum Allowable Time - Current Curves of Overcurrent Protection at Customer LV Main Switch (PC/835/02/60/0578).
GCS/4/04	Recommended C.T. Arrangement for Customer's Protective Device at Main Switch.

GCS/4/05

LV Main Switch Protection Scheme Summary Sheet

GCS/4/06

HV Main Switch Protection Scheme Summary Sheet

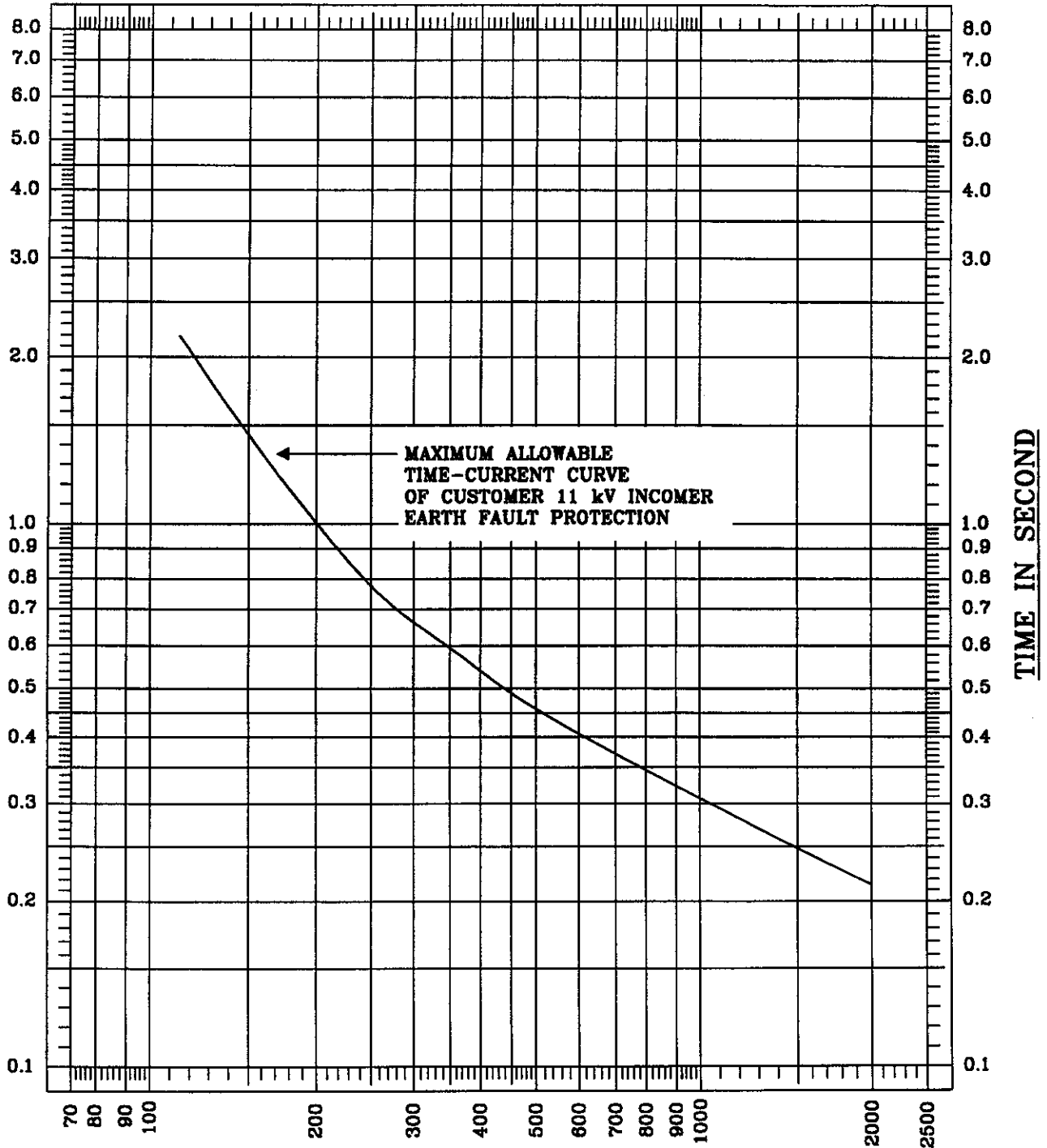


CURRENTS IN AMPERES AT 11 kV SIDE

Drg. No. GCS/4/01

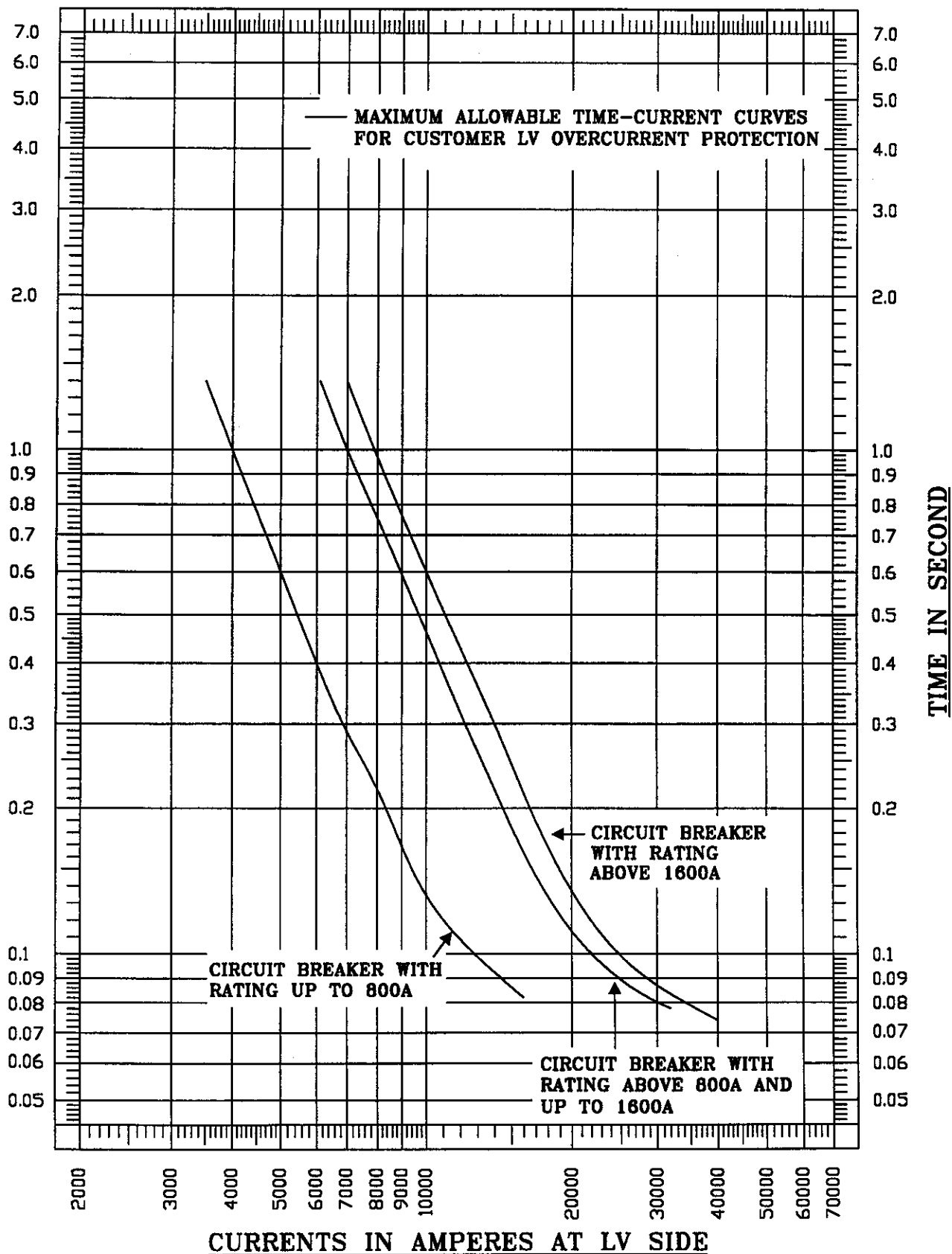
MAXIMUM ALLOWABLE TIME-CURRENT CURVE OF OVERCURRENT  
PROTECTION AT CUSTOMER 11kV MAIN SWITCH

(PC/835/02/60/0576)



CURRENTS IN AMPERES AT 11 kV SIDE

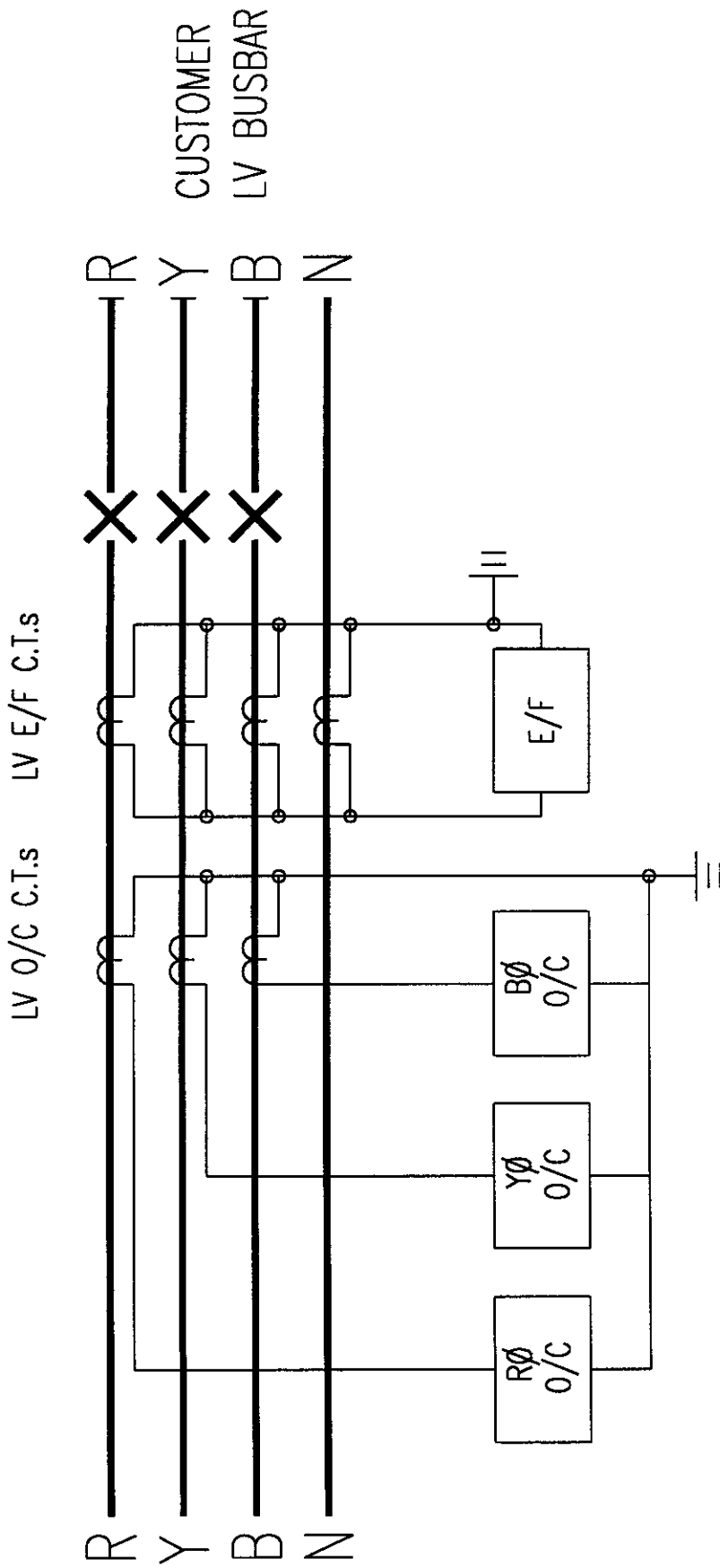
Drg. No. GCS/4/02  
MAXIMUM ALLOWABLE TIME-CURRENT CURVE OF EARTH  
 FAULT PROTECTION AT CUSTOMER 11kV MAIN SWITCH  
(PC/835/02/60/0577)



Drg. No. GCS/4/03

**MAXIMUM ALLOWABLE TIME-CURRENT CURVES OF OVERCURRENT  
PROTECTION AT CUSTOMER LV MAIN SWITCH**

(PC/835/02/60/0578)



Drg. No. GCS/4/04  
**RECOMMENDED C.T. ARRANGEMENT FOR CUSTOMER'S PROTECTIVE DEVICE AT MAIN SWITCH**

1. Circuit Breaker Information : (Main Switch No. : \_\_\_\_\_ )

Main Switch Rating	Any Built-in Protective Device ?	Instantaneous Trip Current Setting (kA) and Max. Setting Error	Setting Details
	<input type="checkbox"/> Yes <input type="checkbox"/> No		

2. Current Transformer :

Function	Make	Model Number	Ratio	VA and Class	Any C.T. Magnetisation Curve Provided to HEC ?	C.T. Resistance (ohm)	Connection Lead Resistance (ohm)
Overcurrent Protection C.T.					<input type="checkbox"/> Yes <input type="checkbox"/> No, to be submitted later		
Earth Fault Protection C.T.					<input type="checkbox"/> Yes <input type="checkbox"/> No, to be submitted later		

Will the overcurrent protection and earth fault protection share the same set of C.T.s ?  Yes  No

3. Relay Information :

Function	Make	Model Number	Rated Current (A)	Burden at Rated Current (VA)	* Characteristics e.g. EI, VI, NI(1.3 sec.), NI(3 sec.)	Plug Setting Range	Plug Setting	Time Multiplier Setting	Relay Impedance at Plug Setting (ohm)
Overcurrent Relay									
Earth Fault Relay									

(\* : EI = Extremely Inverse, VI = Very Inverse, NI= Normal Inverse)

4. Maximum Earth Fault Loop Impedance (ohm), if available at the time of submission :

Notes : Following information shall be provided :

1. Catalogues for main switch (with details of built-in protective device, if any), C.T.s (including C.T. magnetisation curve) and relays.
2. A.C. connection diagram of overcurrent and earth fault protection for the main switch.
3. Calculation sheet showing that the proposed C.T.s have adequate output for the application under both phase and earth fault conditions.
4. Time-current characteristic curve of overcurrent protection at the proposed settings plotted at the Drg. No. GCS/4/03.

Drg. No. GCS/4/05

L V MAIN SWITCH PROTECTION SCHEME SUMMARY SHEET

1. Circuit Breaker Information : (Main Switch No. : \_\_\_\_\_ )

Main Switch Rating	Any Built-in Protective Device ?	Instantaneous Trip Current Setting (kA) and Max. Setting Error	Setting Details
	<input type="checkbox"/> Yes <input type="checkbox"/> No		

2. Current Transformer :

Function	Make	Model Number	Ratio	VA and Class	Any C.T. Magnetisation Curve Provided to HEC ?	C.T. Resistance (ohm)	Connection Lead Resistance (ohm)
Overcurrent Protection C.T.					<input type="checkbox"/> Yes <input type="checkbox"/> No, to be submitted later		
Earth Fault Protection C.T.					<input type="checkbox"/> Yes <input type="checkbox"/> No, to be submitted later		

Will the overcurrent protection and earth fault protection share the same set of C.T.s ?  Yes  No

3. Relay Information :

Function	Make	Model Number	Rated Current (A)	Burden at Rated Current	* Characteristics e.g. EI, VI, NI(1.3 sec.), NI(3 sec.)	Plug Setting Range	Plug Setting	Time Multiplier Setting	Relay Impedance at Plug Setting (ohm)
Overcurrent Relay									
Earth Fault Relay									

(\* : EI = Extremely Inverse, VI = Very Inverse, NI = Normal Inverse)

Notes : Following information shall be provided :

1. Catalogues for main switch (with details of built-in protective device, if any), C.T.s (including C.T. magnetisation curve) and relays.
2. A.C. connection diagram of overcurrent and earth fault protection for the main switch.
3. Calculation sheet showing that the proposed C.T.s have adequate output for the application under both phase and earth fault conditions.
4. Time-current characteristic curves of overcurrent protection and earth fault protection at the proposed settings plotted at the Drg. No. GCS/4/01 & GCS/4/02 respectively.

Drg. No. GCS/4/06

HV MAIN SWITCH PROTECTION SCHEME SUMMARY SHEET