



# Engineering Procedure

## Electrical

### CRN EL 005

# DEMARCATIION OF JHR CRN LOW VOLTAGE DISTRIBUTION

Version 1.1

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**Owner: Principal Signal Engineer**

**Approved by: Stewart Rendell**

**Authorised by: James Zeaiter**

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## Document control

| Revision | Date of Approval | Summary of change  |
|----------|------------------|--|
| V2.0     | March 2005       | EP 17 00 00 12 SP Demarcation of RIC Low Voltage Distribution System |
| V1.0     | January 2012     | Conversion to CRN Signalling Standard CRN SP 041                     |
| V1.1     | August 2016      | Review and Update  |
|          |                  |  |
|          |                  |  |
|          |                  |  |

## Summary of changes from previous version

| Section | Summary of change        |
|---------|--------------------------|
| 3.2     | Update ownership details |
| 3.4     | Update ownership details |
| 6       | Update ownership details |
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|         |                          |
|         |                          |

# Contents

|          |   |          |
|----------|---|----------|
| <b>1</b> | <b>References</b> .....   | <b>4</b> |
| <b>2</b> | <b>Definitions</b> .....  | <b>4</b> |
| <b>3</b> | <b>Equipment ownership</b> .....  | <b>6</b> |
| 3.1      | JHR CRN LV Distribution Equipment .....   | 6        |
| 3.2      | Consumer's Installation .....   | 6        |
| 3.3      | Local Electricity Distributor's Equipment .....   | 7        |
| 3.4      | Meters.....   | 7        |
| <b>4</b> | <b>Payment for electricity</b> .....  | <b>7</b> |
| 4.1      | 4.1. Supply from the JHR CRN network only.....  | 7        |
| 4.2      | Supply from the Local Electricity Distributor's Network only .....  | 8        |
| 4.3      | Connections to both JHR CRN and the Local Electricity Distributor via a common changeover contactor ..... | 8        |
| 4.4      | Connections to both JHR CRN and Local Electricity Distributor via two or more changeover contactors ..... | 8        |
| 4.5      | Major installations .....   | 9        |
| <b>5</b> | <b>Installation Inspections</b> .....   | <b>9</b> |
| 5.1      | General .....   | 9        |
| 5.2      | Connection to JHR CRN System only.....  | 9        |
| 5.3      | Connection to Local Electricity Distributor only .....  | 9        |
| 5.4      | Supplies from both JHR CRN and Local Electricity Distributor .....  | 9        |
| 5.5      | Supply to other consumers.....  | 10       |

# 1 References

- John Holland Rail Country Regional Network EL 002 (CRN EL 002) Earthing, Bonding & Electrolysis
- Electricity Supply Act – 1995
- AS 3000 “SAA Wiring Rules”
- Corporation 28 June 1996
- NSW Service and Installation Rules – Electricity Association of NSW March 1999

# 2 Definitions

Terms not defined here shall have the meanings defined in the references listed in section 1.

## **Consumer’s installation**

This comprises the consumer’s mains, Installation Main Switchboard, and all equipment and wiring downstream of the Installation Main Switchboard.

## **Consumer’s mains**

The conductors between the Consumer’s Terminals and main switchboard. They are determined in accordance with the NSW Service and Installation Rules.

## **Consumer’s Terminals**

The point at which the Distributor’s system is connected to the consumer’s installation. The Consumer’s Terminals define the boundary between the customer’s installation and the Electricity Distributor’s system.

- In most cases, this will be the line side terminals (links or circuit breaker terminals) of the Supply Main Switchboard.
- In major installations, multiple 415 V switchboards with 415 V bus ties and multiple incoming supplies are installed. These switchboards are defined as being the Installation Main Switchboard and the Consumer’s Terminals are the line side of the supply main switches.

## **Distribution system**

This includes the electricity power lines and associated equipment and structures that are used to convey electricity to the premises of consumers.

## **Earthing system**

A group of conducting elements, both vertical and horizontal, in electrical contact with the earth designed to disperse electrical fault currents into the earth and to control touch and step voltages.

## **Electricity Distributor**

A person who owns or controls a distribution system.

Electricity Supplier, Electricity Retailer, Supplier, Retailer A person who supplies electricity under a Customer Supply Contract.

## **Embedded JHR CRN customer**

A customer (tenant) supplied by JHR CRN, utilising in part the assets belonging to another party (landlord ).

### **Embedded customer's terminals**

The point at which the consumer's installation connects to the embedded customer's (tenant's) installation.

### **High voltage**

A voltage exceeding 1000 Vac or 1500 Vdc.

### **Installation Main Switchboard**

The low voltage switchboard from which the supply to the whole installation can be controlled. In AS 3000 this is referred to as the "main switchboard". The "installation" prefix is used in this document to distinguish the Installation Main Switchboard from the Supply Main Switchboard. An installation is as defined in AS 3000, SAA Wiring Rules. For existing installations connected to JHR CRN's LV distribution system, this switchboard usually contains the Consumer's Terminals and the main earth terminal. When there is not sufficient space on the Installation Main Switchboard to install metering equipment, a small meter panel may be installed nearby. In this case, the small panel is taken to form part of the Installation Main switchboard and the service mains terminate on it.

### **Local Electricity Distributor, Local Distributor**

The organisation which owns and controls the principal distribution system in the Distribution District in which the installation is located. It owns and controls the wiring which conveys electricity to a consumer. JHR CRN is an Electricity Distributor but is never the Local Electricity Distributor. (See NSW Installation Rules, clause 1.1.16)

### **Low voltage**

A voltage exceeding 32 Vac or 115 Vdc but not exceeding 1000 Vac or 1500 Vdc.

### **Near 1500 V track**

That area inside the railway boundary and within:

- 20 m of the centreline of any track with 1500 V overhead wiring, or
- 20 m of any 1500 V negative equipment or conductors, or
- 20 m of any metal which is spark gapped to rail and measured horizontally and at right angles to the track centre line.

### **Service equipment**

The metering and control equipment supplied and installed as specified in the applicable service and installation rules. It may include service fuses, circuit breakers, meters, CTs, links.

### **Supply Main Switchboard**

The first low voltage switchboard between the supply transformer terminals and the low voltage installation. The Supply Main Switchboard is owned by JHR CRN and is the location to establish the one and only connection between earth and neutral. In some installations, there is no Supply Main Switchboard.

### **Supply Authority**

A distributor or generator engaged in the distribution of electricity to the public, under the Electricity Safety Act. It is responsible for the safety of consumers' installations.

### **Switchboard**

Any distribution board or switchboard other than the Supply Main Switchboard or Installation Main Switchboard.

## 3 Equipment ownership

JHR CRN always owns the low voltage equipment fed from any JHR CRN HV substation down to the Consumer's Terminals on the load side of the Supply Main Switchboard(s). JHR CRN always owns the LV earthing system.(ie earth stakes and connections to earth link, water pipes etc.)

Where the Supply Main Switchboard does not exist, or where there is a changeover contactor shared by JHR CRN and the consumer, JHR CRN ownership extends to include the changeover contactor. JHR CRN also owns any service equipment on the consumer's Installation Main Switchboard

Where an isolating transformer is used to separate a Local Electricity Distributor's MEN earth system from the installation, then JHR CRN owns all equipment between the Consumer's Terminals at the Local Distributor's connection point and the Consumer's Terminals where JHR CRN provides connection to its consumers. Typically this equipment includes the service pole, meter box, MEN earthing system, isolating transformer, and all wiring from the local Electricity Distributor's Consumer's Terminals to the Installation Main Switchboard.

In special situations, connection may be made to the Local Distributor via a dedicated HV/LV transformer. This transformer performs the role of the isolating transformer, and the LV earth system must not be connected to the Distributor's MEN system. The Distributor owns the transformer and equipment down to the Consumer's Terminals. JHR CRN will own the earthing system and wiring between the Distributor's Consumers's Terminals and the Consumer's Terminals on the Installation Main switchboard.

JHR CRN always owns the LV earthing system. ie the earth stakes, the earth link on the Supply Main Switchboard, and the connection between. All other earth and safety connections form part of the consumer's installation.

Figures 1 to 7 show the most common arrangements in use on the JHR CRN system. All consumers physically connected to JHR CRN's LV Distribution system shall be connected under a Customer Connection Contract.

### 3.1 JHR CRN LV Distribution Equipment

#### 3.1.1 Small installations

Small Installations are all those not included under Major Installations, refer to section 3.1.2 for details.

See Figures 1 to 5 for more information.

#### 3.1.2 Major installations

In certain major installations, multiple 415 V switchboards connected to different sources, and with 415 V bus tie circuit breakers, are installed. (The multiple boards may be physically combined in one assembly.)

This is the Installation Main Switchboard. JHR CRN has the sole operating rights for the supply main switches and LV bus tie switches, although they are supplied, owned and maintained by the consumer. See Figure 6. In this arrangement only, the only earth-neutral connection is established on the Installation Main Switchboard. JHR CRN owns and maintains the earth system. There is no Supply Main Switchboard. This arrangement is not preferred and Figure 7 shows the preferred arrangement for future work.

### 3.2 Consumer's Installation

The consumer's mains, Installation Main Switchboard and all equipment/wiring downstream of the Installation Main Switchboard (excluding any service equipment), is defined as the 'installation' and may be owned by JHR CRN, TfNSW, NSW TrainLink, ARTC or any other consumer.

Where a changeover contactor is installed to provide backup supply to non-JHR CRN equipment only, this changeover contactor is owned by the consumer, e.g. a changeover contactor supplying an SRA station. Refer to section 4.4.2.

JHR CRN provides supply to many of TfNSW's tenants, which are 'embedded' with TfNSW's installation. ie TfNSW equipment is used to carry the electricity to JHR CRN's customers. The tenant's consumers terminals location will be determined by TfNSW, and will usually be the tenant's premises. (ie TfNSW will own the sub mains feeding the tenant.)

### 3.3 Local Electricity Distributor's Equipment

The Local Electricity Distributor owns equipment as set out in the NSW Service and Installation rules.

Where there is no isolating transformer, (i.e. not 'near 1500 V track') and no JHR CRN supply, then JHR CRN is not involved. The NSW Service and Installation Rules apply.

### 3.4 Meters

Normally, meters will be owned by the Electricity Supplier who has contracted to sell energy to the consumer. This can be a different organisation to the Local Electricity Distributor. Where a customer is sub-fed from another consumer's installation, (e.g. see Figure 2 where JHR CRN is a customer of TfNSW), the organisation reselling the energy will determine the ownership of any meters installed for the sub-fed customer.

## 4 Payment for electricity

The supply of electricity is assumed to take place under a competitive market, and the consumer is able to purchase energy from any Electricity Supplier, not necessarily from JHR CRN. The following information and figures are based on the assumption that the consumer has elected to purchase energy from JHR CRN, through JHR CRN's network. The consumer will have a Customer Supply Contract as well as a Customer Connection Contract with JHR CRN.

If the consumer is purchasing electricity from another Supplier, then JHR CRN will not be involved in metering that consumer and the consumer will have only a Customer Connection Contract with JHR CRN.

In many cases, JHR CRN will be a low voltage customer of another consumer and will pay that consumer for energy purchased. (e.g. see Figure 2).

Note that in this section, "supply" refers to the sale of energy only and "connection"

refers to the physical connection ('wires') for the delivery of the energy.

### 4.1 4.1. Supply from the JHR CRN network only

JHR CRN will provide metering, as required by agreement, for installation on the Installation Main Switchboard which shall be provided by the consumer. JHR CRN will provide accounts to the consumer for electricity purchased.

See Figures 1a and 1b.

## **4.2 Supply from the Local Electricity Distributor's Network only**

### **4.2.1 Not 'near 1500 V track'**

The consumer's Supplier will provide accounts direct to the consumer. JHR CRN will not be involved in metering.

### **4.2.2 Near 1500 V track, no JHR CRN LV load**

The consumer's Supplier will provide accounts direct to the consumer. JHR CRN will not be involved in metering. See Figure 2. JHR CRN will charge for the use of its network.

### **4.2.3 Near 1500 V track, JHR CRN load and other consumers connected**

The consumer's Supplier will provide accounts direct to the "main" consumer, usually the largest load or the owner of the premises. If JHR CRN is not the "main" consumer, then JHR CRN will purchase its energy from the "main" consumer based on either meter readings or other agreed methods. See Figure 2.

## **4.3 Connections to both JHR CRN and the Local Electricity Distributor via a common changeover contactor**

This situation is where a changeover contactor is installed primarily for JHR CRN's use, but is used by another consumer(s) as well. This is not an JHR CRN preferred arrangement. See Figure 3.

Because of this connection, the non-JHR CRN consumer must purchase from JHR CRN and,

- JHR CRN will provide meters at the Installation Main Switchboard and will provide accounts to the consumer for electricity consumed.
- JHR CRN will pay for all the electricity supplied via the Local Electricity Distributor's system.
- JHR CRN will provide a tariff, which reflects the increased reliability of supply to the consumer and the cost of energy purchased.

## **4.4 Connections to both JHR CRN and Local Electricity Distributor via two or more changeover contactors**

### **4.4.1 Single isolating transformer and Local Electricity Distributor connection**

The following describes the situation where JHR CRN installs a changeover contactor for its requirements and another consumer installs another dedicated, changeover contactor to provide extra security of supply for itself, and both are connected to the same Local Electricity Distributor via a single isolating transformer.

See Figure 4a for the preferred arrangement for future use where the supply of energy is contestable. In this case,

- JHR CRN will provide meters on its supply at the consumer's changeover contactor and will provide accounts to the consumer for electricity consumed.
- JHR CRN will arrange for the supply to its changeover contactor and pay for this supply.
- The consumer must arrange with a Supplier for the supply via the Local Distributor.

See Figure 4b for the existing situation where the Local Distributor is also the Supplier. Because of the connections, the non-JHR CRN consumer must purchase from JHR CRN. In this case,

- JHR CRN will provide meters on the load side of the consumer's changeover contactor and will provide accounts to the consumer for electricity consumed.



- JHR CRN will arrange for the supply from the Local Distributor and pay this account.
- JHR CRN will provide a tariff, which reflects the increased reliability of supply to the consumer and the cost of energy purchased from the Local Distributor.

#### **4.4.2 Separate Local Electricity Distributor supplies**

As an alternative, separate Local Electricity Distributor connections can be obtained to supply each changeover contactor, with separate isolating transformers. This allows meters to be installed on the line side of the isolating transformers. See Figure 5.

- JHR CRN will provide meters on its supply at the consumer's changeover contactor and will provide accounts to the consumer for electricity consumed.
- JHR CRN will arrange for the supply to its changeover contactor and pay for this supply.
- The consumer must arrange with a Supplier for the supply via the Local Distributor.

### **4.5 Major installations**

#### **4.5.1 415 V switchboard as Installation Main Switchboard**

See Figures 6 & 7. Connections to any incoming JHR CRN supplies will be metered by JHR CRN. JHR CRN will provide meters, etc. (as required) to be installed in or on the Installation Main Switchboard which shall be provided by the consumer. JHR CRN will provide accounts to the consumer for electricity purchased from JHR CRN.

The consumer will arrange for supply from any non-JHR CRN Supplier and will be billed by that Supplier.

## **5 Installation Inspections**

### **5.1 General**

Those Installation Inspections which are JHR CRN's responsibility will be carried out by Installation Inspection Contractors in accordance with CRN EI 001 – "Installation Inspections".

### **5.2 Connection to JHR CRN System only**

Installation Inspections will be provided by JHR CRN as the Supply Authority. See Figures 1a and 1b.

### **5.3 Connection to Local Electricity Distributor only**

#### **5.3.1 Not 'near 1500 V track'**

Where an installation is connected to the Local Electricity Distributor only, then that Distributor will be the Supply Authority responsible for all Installation Inspections. JHR CRN will have no involvement.

#### **5.3.2 Near 1500 V track**

Where an installation is connected to the Local Electricity Distributor via an isolating transformer, then JHR CRN will be the Supply Authority responsible for all Installation Inspections.

### **5.4 Supplies from both JHR CRN and Local Electricity Distributor**

Where both JHR CRN and another Distributor provide connections to a consumer, JHR CRN will be the Supply Authority and JHR CRN will provide Installation Inspections on the whole installation. See Figures 3, 4, 5, 6 and 7.

## 5.5 Supply to other consumers

In all cases, where another consumer's installation is sub-fed from the "main" installation, it is inspected by the Supply Authority for the Main Installation, as determined above.

## 6 Rail Infrastructure Corporation

The following figures contain the words "RIC" this will now be read to mean "JHR CRN" John Holland Country Regional Network maintaining and on operating the assets on the behalf of the asset owner Transport for New South Wales (TfNSW).

Figure 1b – Connection to RIC system only, preferred

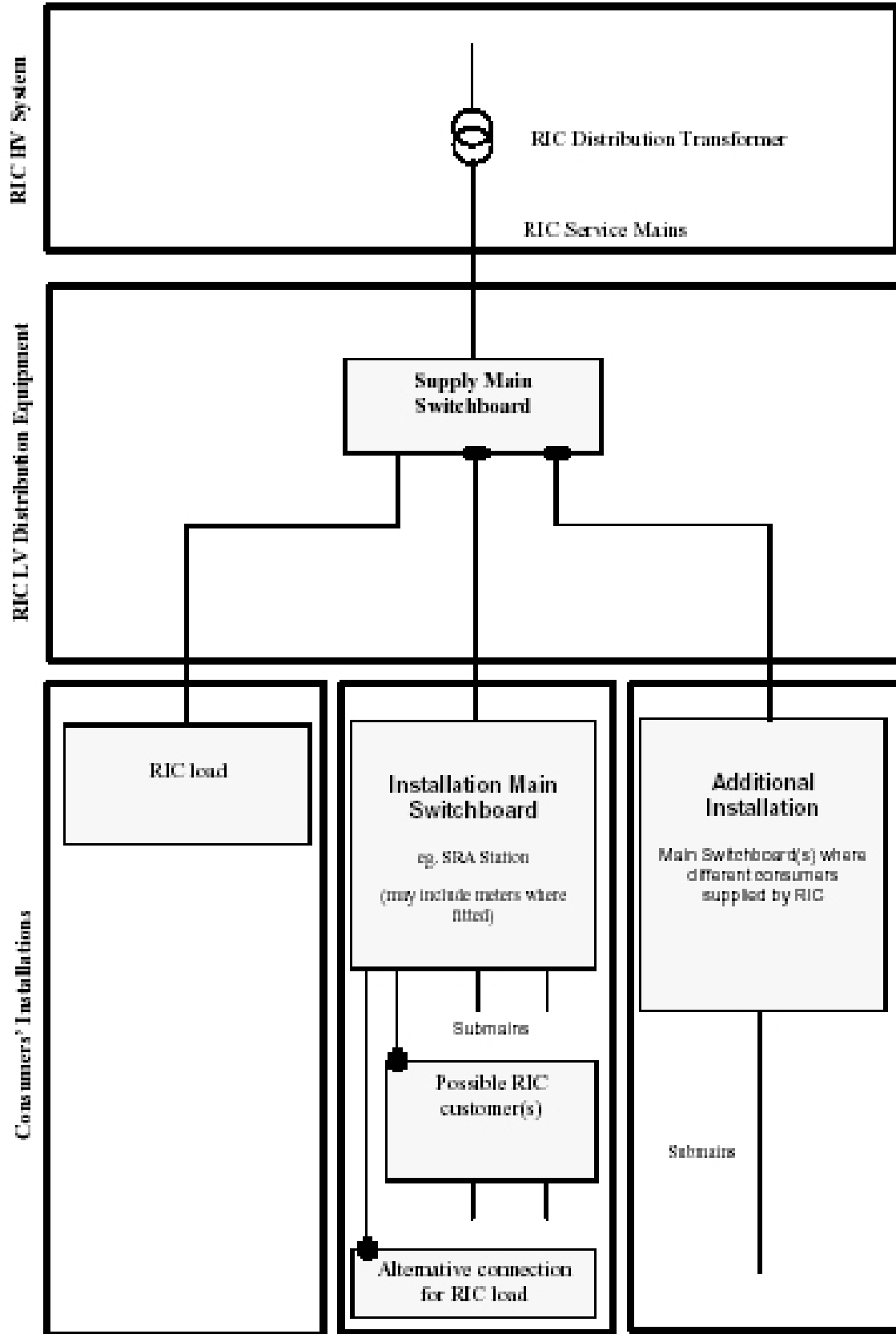
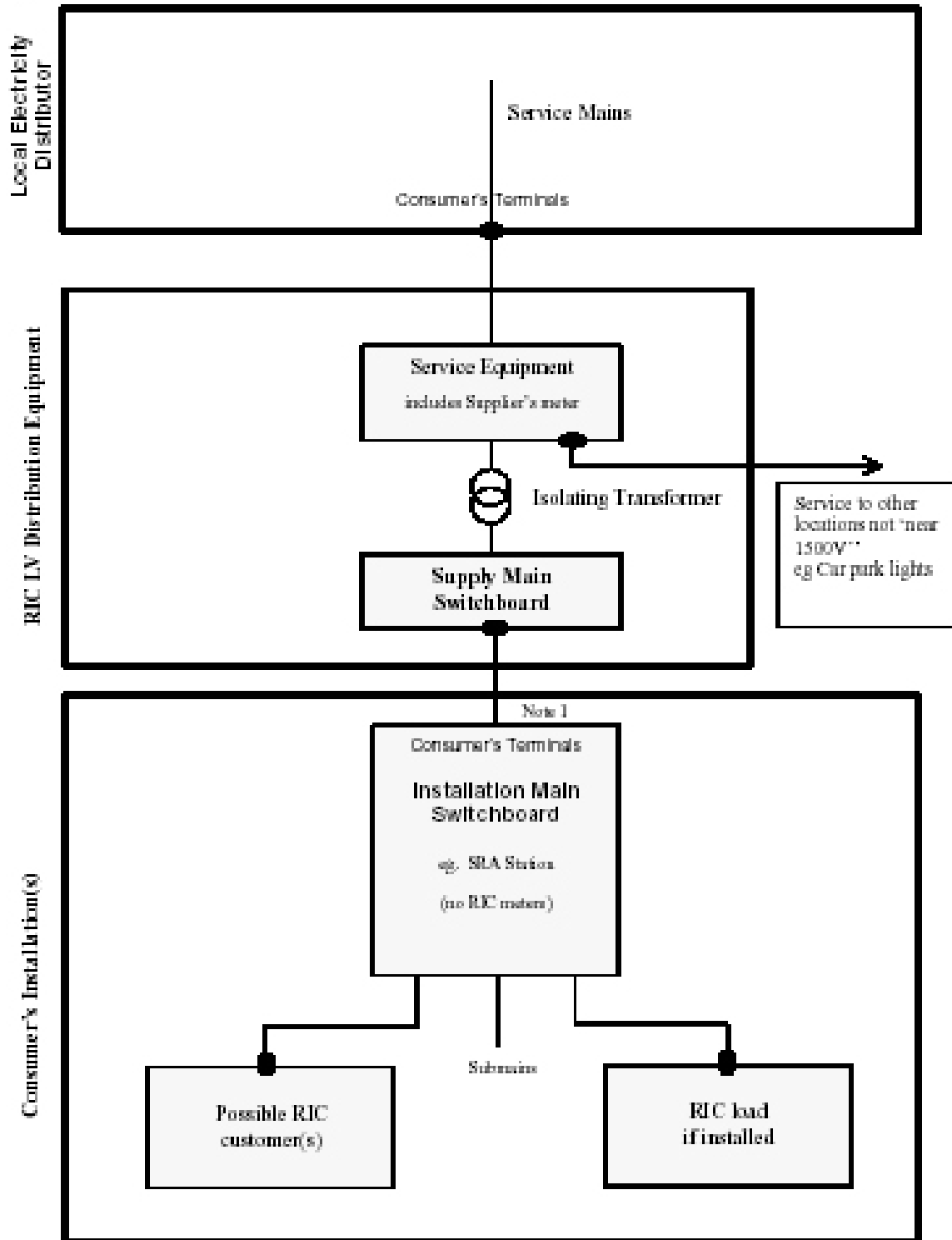


Figure 2 – Connection to Local Distributor only



Note 1: The Consumers Terminals are at the Installation Main Switchboard where the main earth is established at that point. For all future new installations, the main earth is to be established at the Supply Main Switchboard.

Figure 3 – Single changeover contactor supplying RIC and other consumers

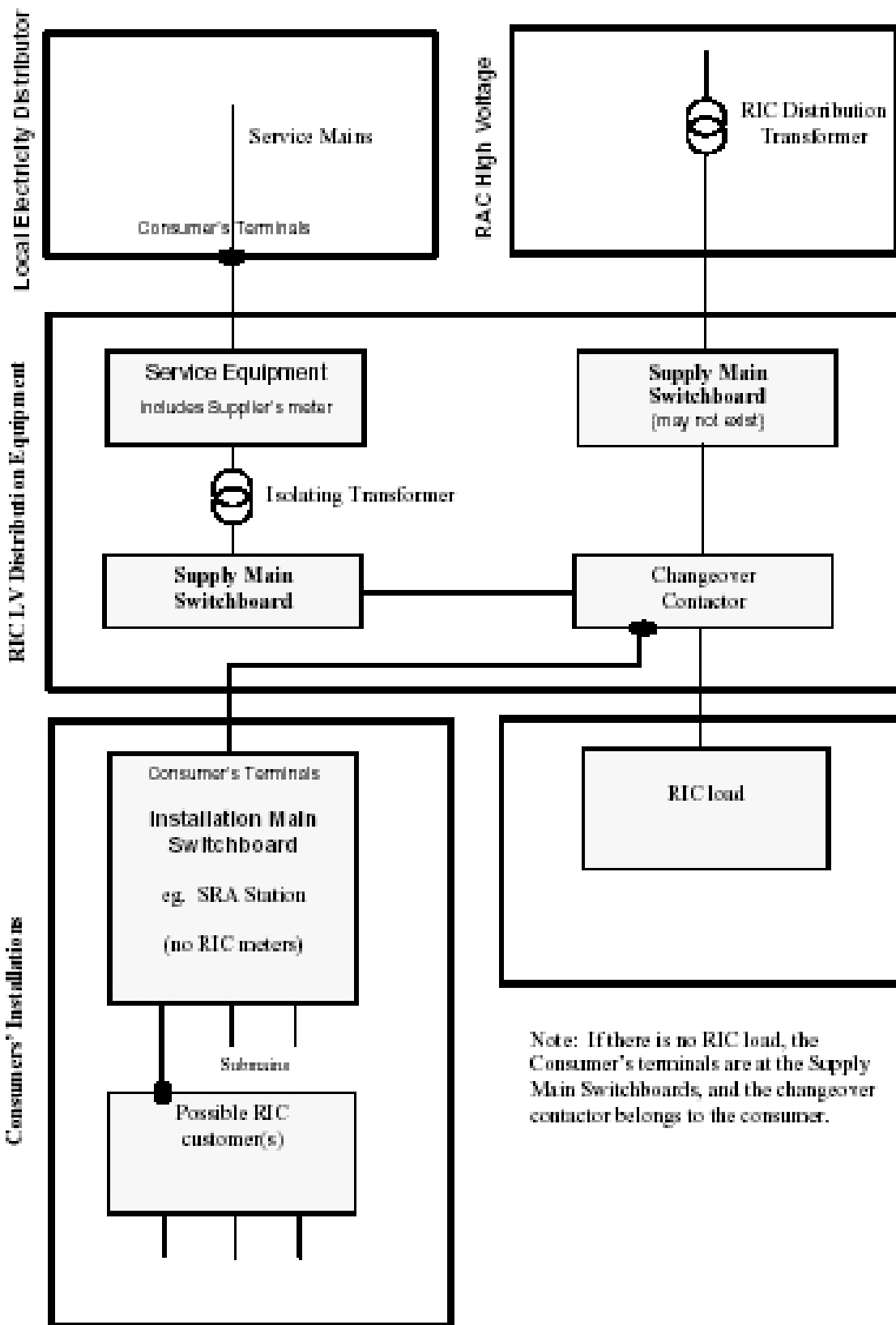


Figure 4a – Two changeover contactors and one Local Distributor connection – future for competitive market

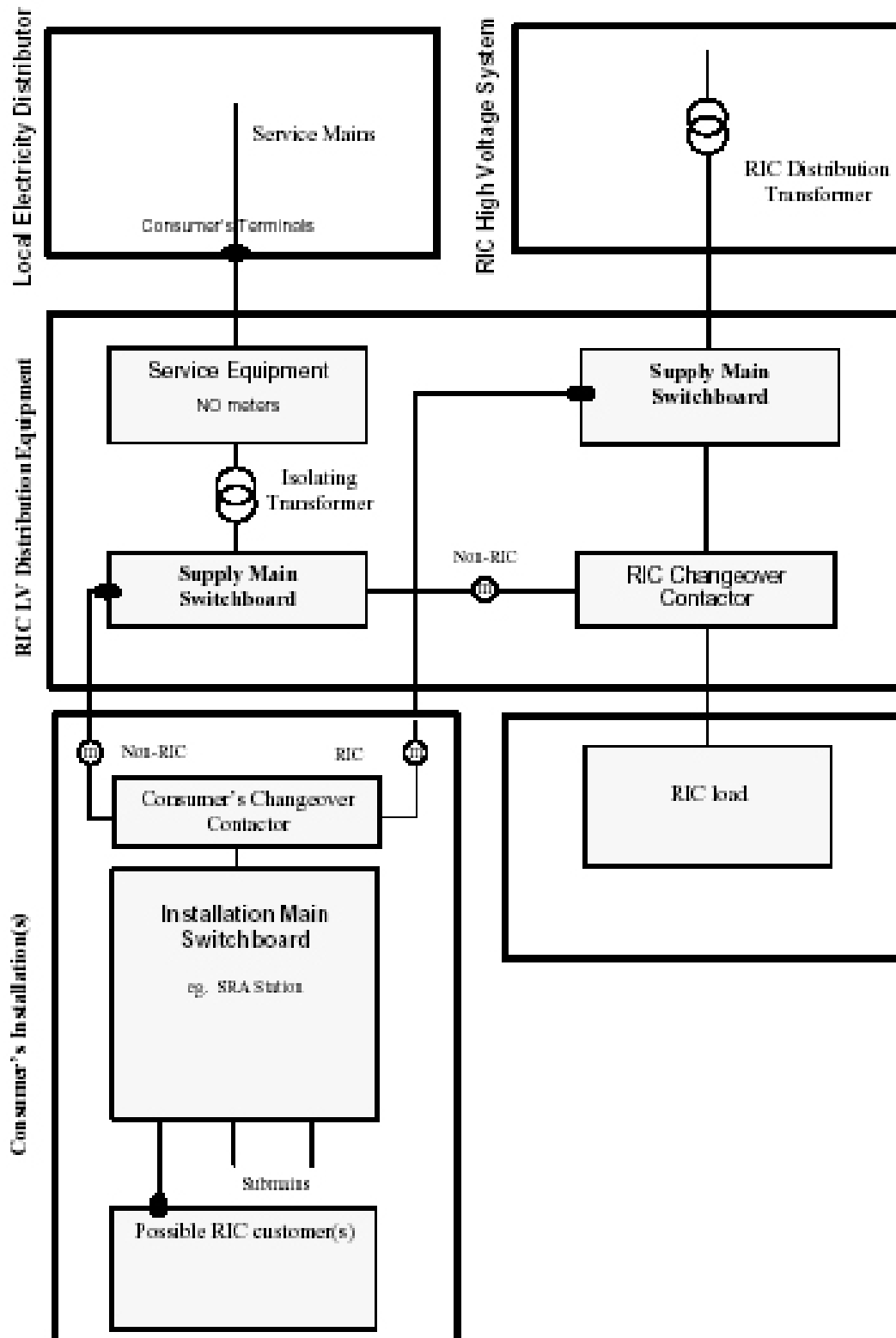


Figure 4b - Two changeover contactors and one Local Distributor connection – existing, non-preferred

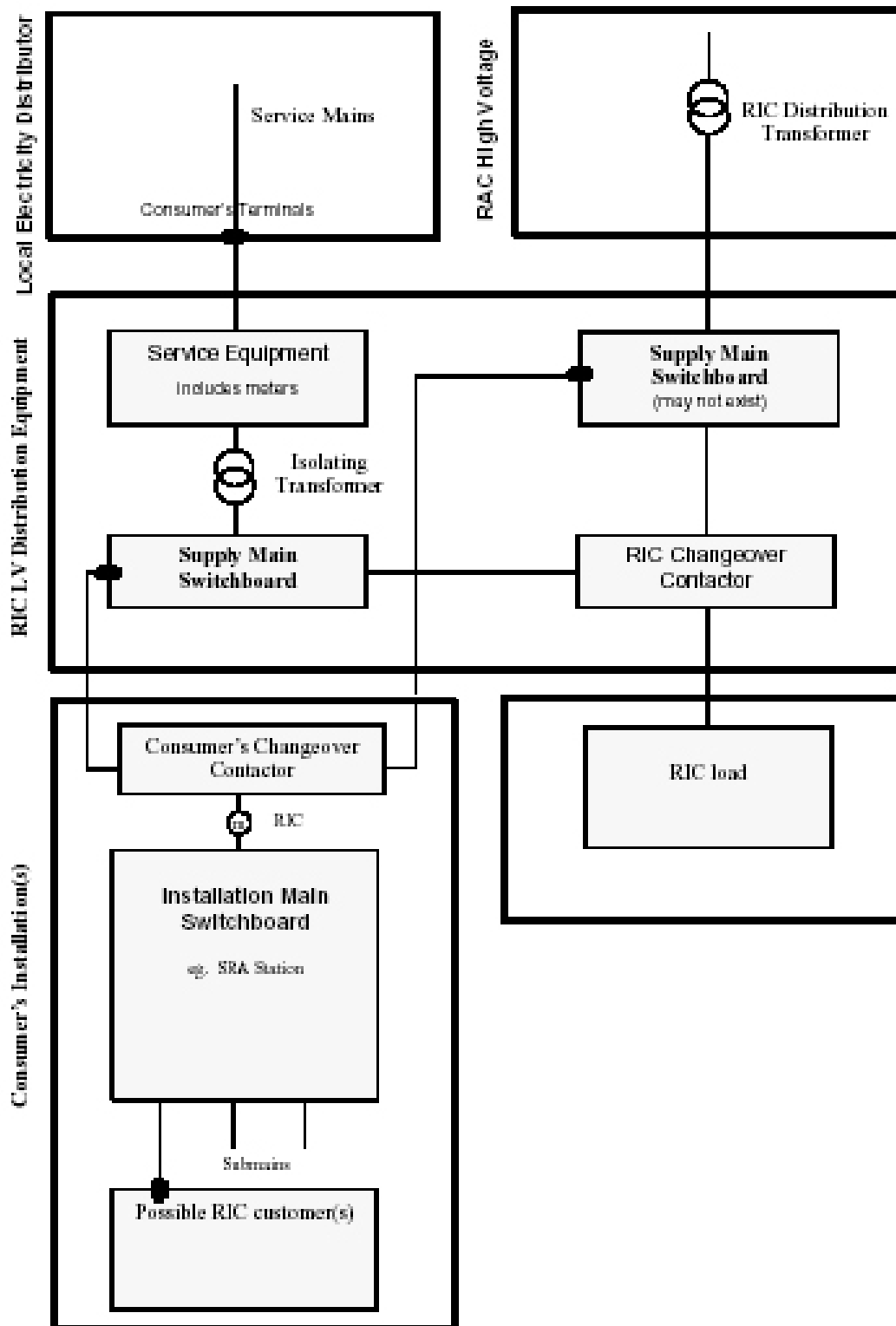


Figure 5 – Two changeover contactors and two Local Distributor connections

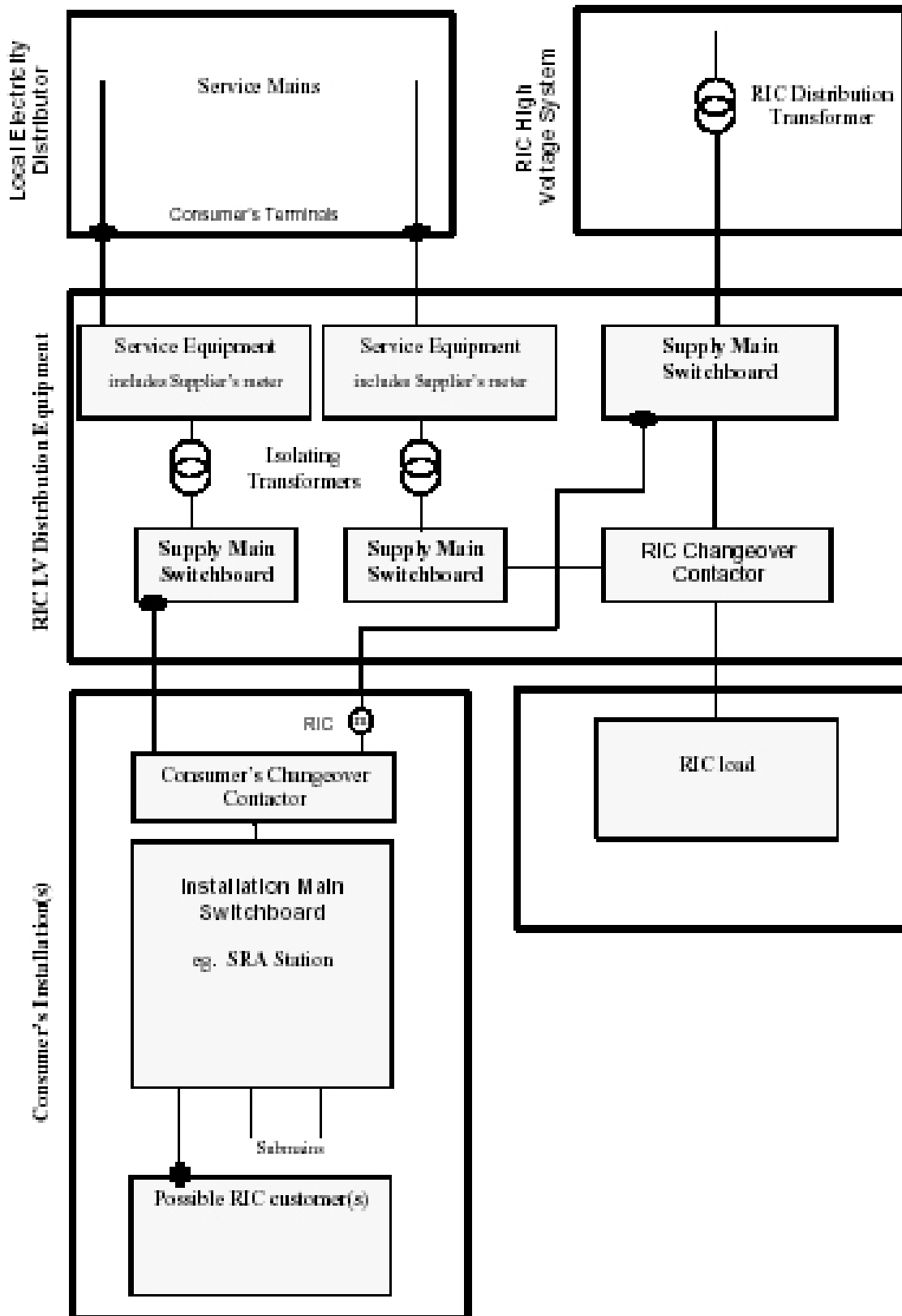
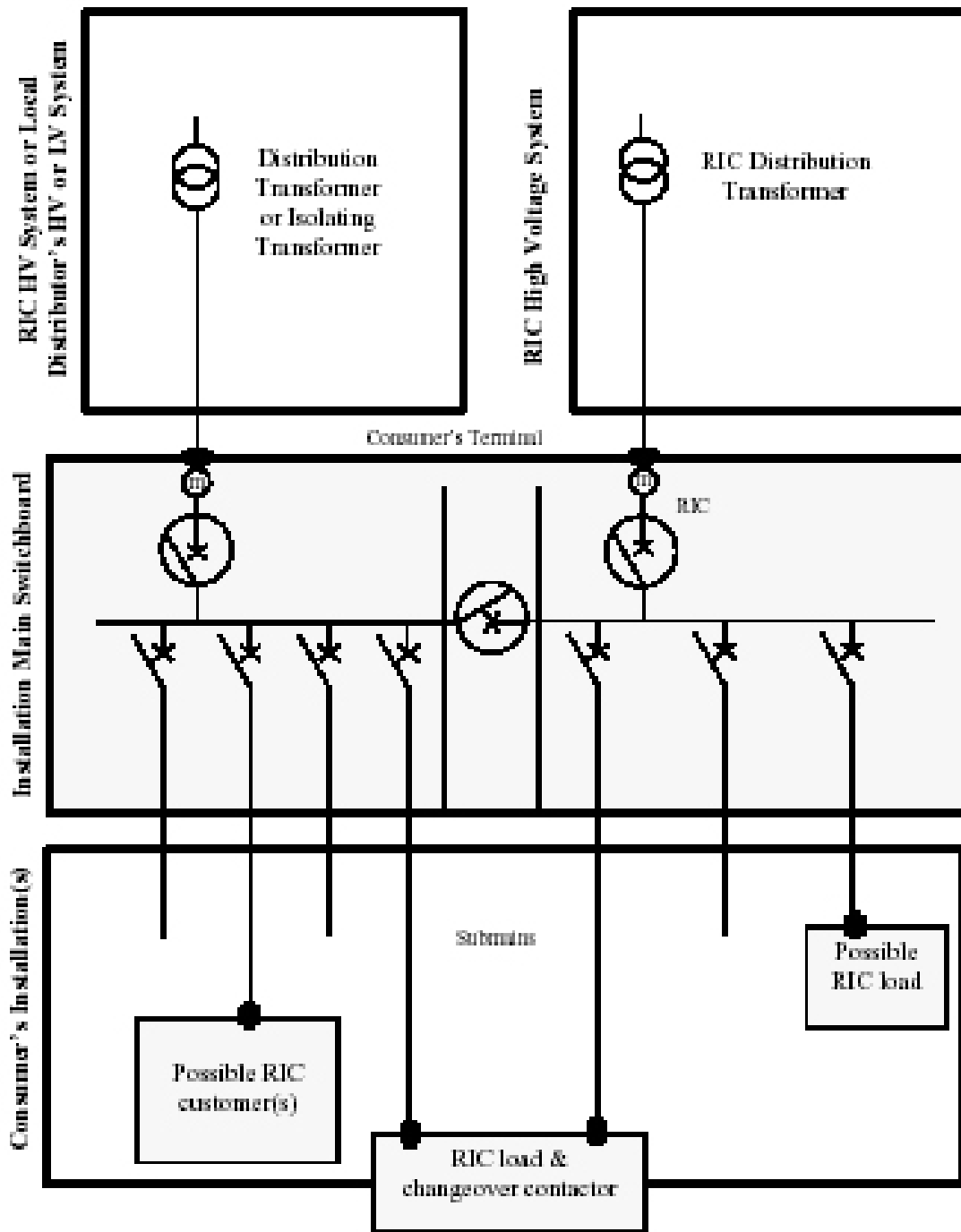




Figure 6 - Major 415V board – existing, non-preferred



**Note:**  
 The Supply Earthing System is installed on the Installation Main Switchboard

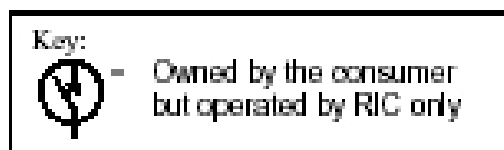
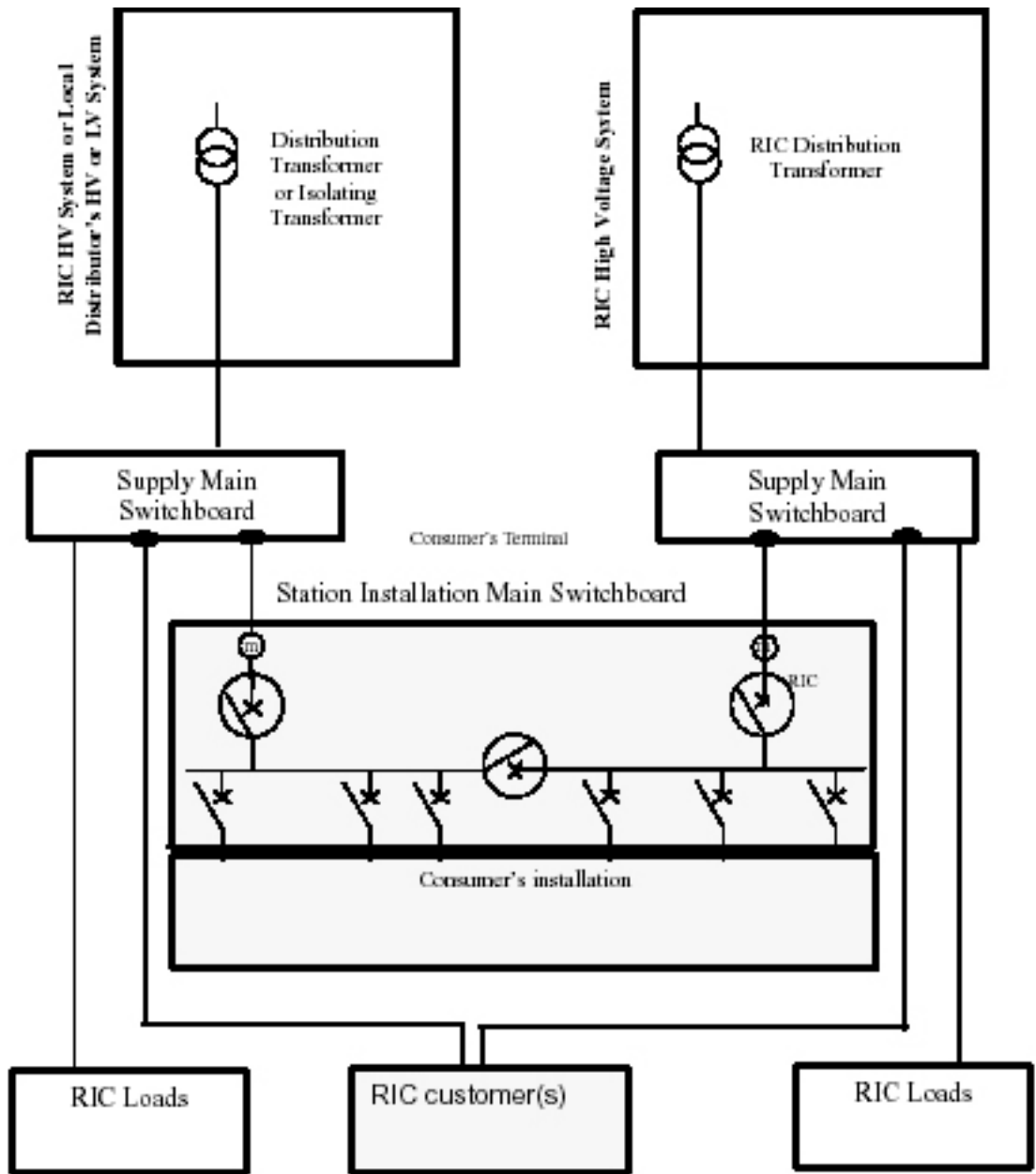


Figure 7 – Major 415V board – preferred

e.



**Note:**  
 The Supply Earthing System is installed on the Installation Main Switchboard

