Discipline
Engineering Standard - NSW

Category
Electrical

Title
Demarcation of ARTC Low Voltage Distribution System

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Document Control

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Document Approval

The technical content of this document has been approved by the relevant ARTC engineering authority and has also been endorsed by the ARTC Safety Committee.

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About This Standard

The ARTC high voltage system is used to provide low voltage power to ARTC installations (e.g. signals), other 'railway' loads (e.g. SRA railway stations and RSA workshops), and to some other private consumers. Because of the manner in which installations were connected prior to ARTC, the boundary between the Electricity Distributor's installation and the consumer's installation is not always obvious.

This document defines the extent of the low voltage equipment, which is owned, maintained and/or operated by ARTC (i.e. the ARTC low voltage distribution system).

It also sets out who is responsible for the 'inspection' of electrical installations supplied by an ARTC LV distribution system and details the ownership of kWh meters.

It does not apply to ARTC as a customer of itself.

It does not cover supply at high voltage.

Document History

Primary Source – RIC Standard EP 17 00 00 12 SP Version 2.0

List of Amendments –

ISSUE	DATE	CLAUSE	DESCRIPTION
1.1	05/01/2005		Reformatted to ARTC Standard
1.2	11/03/2005	Disclaimer	Minor editorial change

Contents

1. References

- PDS 03 - ARTC Earthing, Bonding & Electrolysis, Volume 2.
- Electricity Supply Act – 1995
- AS 3000 “SAA Wiring Rules”
- Transport Administration Act 1998 Section 19J order – Australian Rail Track 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. ARTC is an Electricity Distributor, but not a Local Electricity Distributor.

Electricity Supplier, Electricity Retailer, Supplier, Retailer

A person who supplies electricity under a Customer Supply Contract.

Embedded ARTC customer

A customer (tenant) supplied by ARTC, 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 ARTC'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. ARTC 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 ARTC 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

ARTC always owns the low voltage equipment fed from any ARTC HV substation down to the Consumer's Terminals on the load side of the Supply Main Switchboard(s). ARTC 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 ARTC and the consumer, ARTC ownership extends to include the changeover contactor. ARTC 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 ARTC owns all equipment between the Consumer's Terminals at the Local Distributor's connection point and the Consumer's Terminals where ARTC 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. ARTC will own the earthing system and wiring between the Distributor's Consumer's Terminals and the Consumer's Terminals on the Installation Main switchboard.

ARTC 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 ARTC system.

All consumers physically connected to ARTC's LV Distribution system shall be connected under a Customer Connection Contract.

3.1. ARTC 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. ARTC 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. ARTC 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 ARTC, SRA, FC or any other consumer.

Where a changeover contactor is installed to provide backup supply to non-ARTC 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.

ARTC provides supply to many of SRA's tenants, which are 'embedded' with SRA's installation. ie SRA equipment is used to carry the electricity to ARTC's customers. The tenant's consumers terminals location will be determined by SRA, and will usually be a the tenant's premises. (ie SRA 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 ARTC supply, then ARTC 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 ARTC is a customer of SRA), 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 ARTC. The following information and figures are based on the assumption that the consumer has elected to purchase energy from ARTC, through ARTC's network. The consumer will have a Customer Supply Contract as well as a Customer Connection Contract with ARTC.

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

In many cases, ARTC 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. Supply from the ARTC network only

ARTC will provide metering, as required by agreement, for installation on the Installation Main Switchboard which shall be provided by the consumer. ARTC 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. ARTC will not be involved in metering.

4.2.2. Near 1500 V track, no ARTC LV load

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

4.2.3. Near 1500 V track, ARTC 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 ARTC is not the "main" consumer, then ARTC 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 ARTC and the Local Electricity Distributor via a common changeover contactor

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

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

- ARTC will provide meters at the Installation Main Switchboard and will provide accounts to the consumer for electricity consumed.

- ARTC will pay for all the electricity supplied via the Local Electricity Distributor's system.

- ARTC 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 ARTC 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 ARTC 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,

- ARTC will provide meters on its supply at the consumer's changeover contactor and will provide accounts to the consumer for electricity consumed.

- ARTC 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-ARTC consumer must purchase from ARTC. In this case,

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

- ARTC will arrange for the supply from the Local Distributor and pay this account.

- ARTC 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.

- ARTC will provide meters on its supply at the consumer's changeover contactor and will provide accounts to the consumer for electricity consumed.

- ARTC 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 ARTC supplies will be metered by ARTC. ARTC will provide meters, etc. (as required) to be installed in or on the Installation Main Switchboard which shall be provided by the consumer. ARTC will provide accounts to the consumer for electricity purchased from ARTC.

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

5. Installation Inspections

5.1. General

Those Installation Inspections which are ARTC's responsibility will be carried out by Installation Inspection Contractors in accordance with PMP 03 – "Installation Inspections".

5.2. Connection to ARTC System only

Installation Inspections will be provided by ARTC 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. ARTC 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 ARTC will be the Supply Authority responsible for all Installation Inspections.

5.4. Supplies from both ARTC and Local Electricity Distributor

Where both ARTC and another Distributor provide connections to a consumer, ARTC will be **the** Supply Authority and ARTC 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.

Figure 1a – Connection to RIC system only - existing, non-preferred

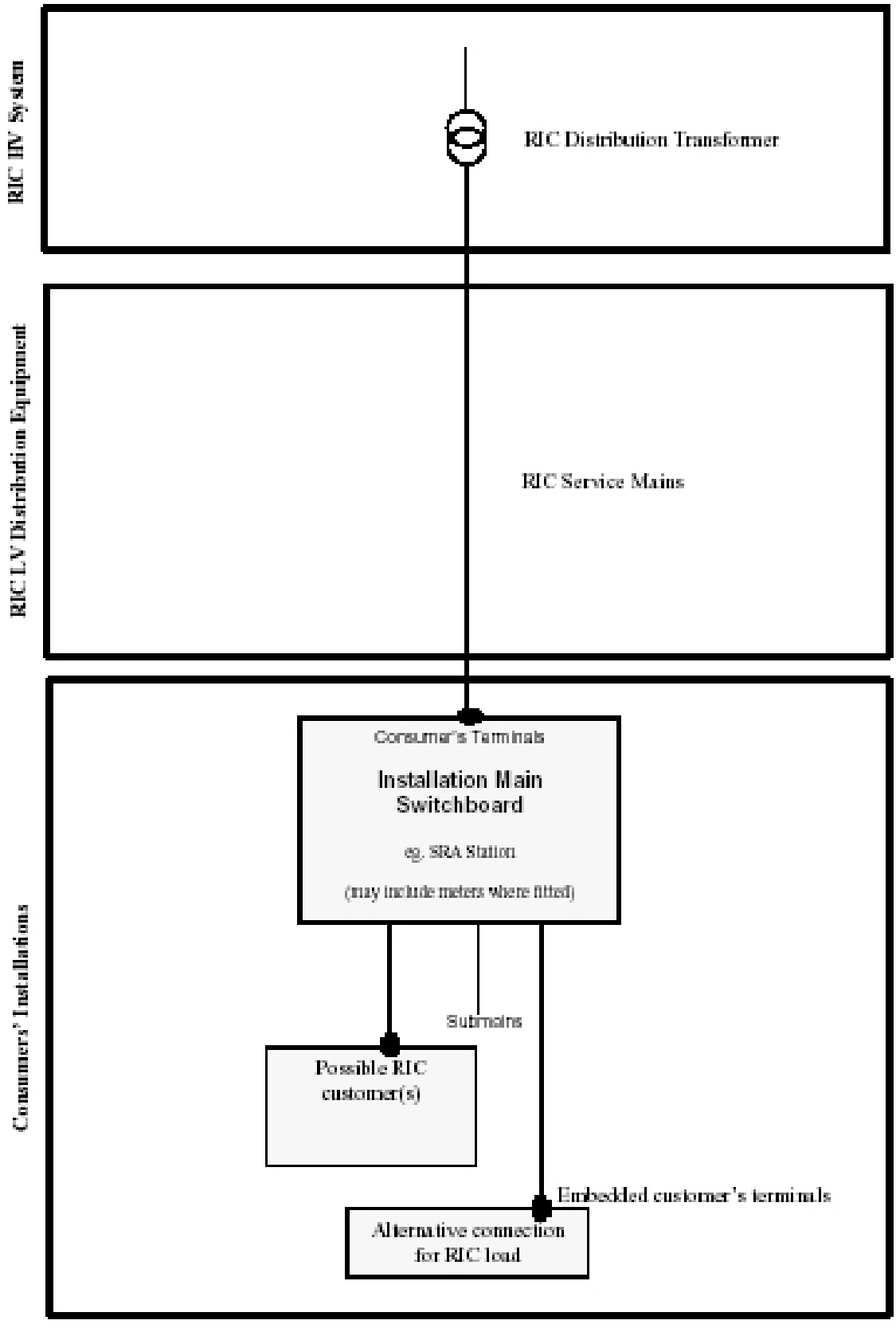


Figure 1b – Connection to RIC system only, preferred

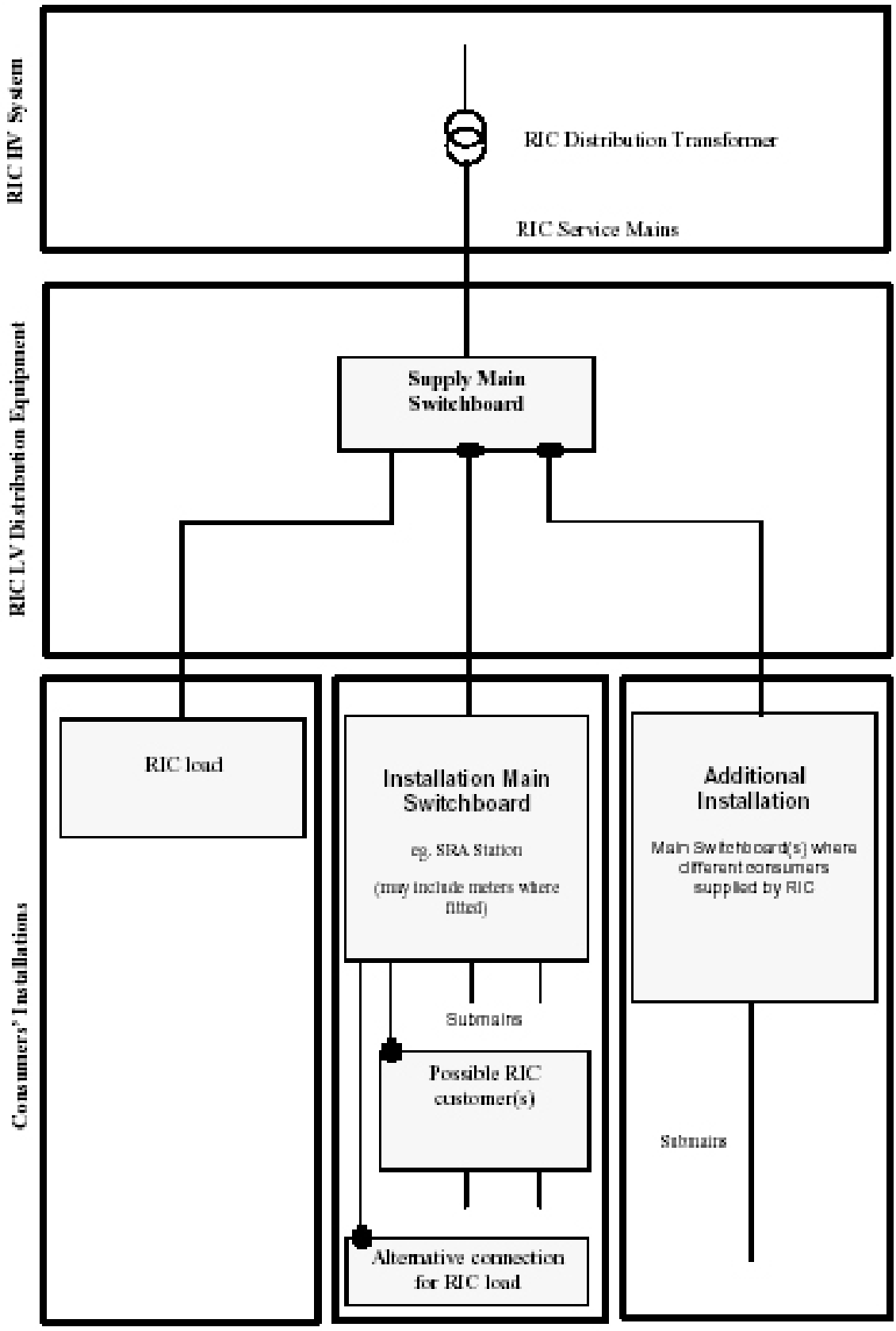
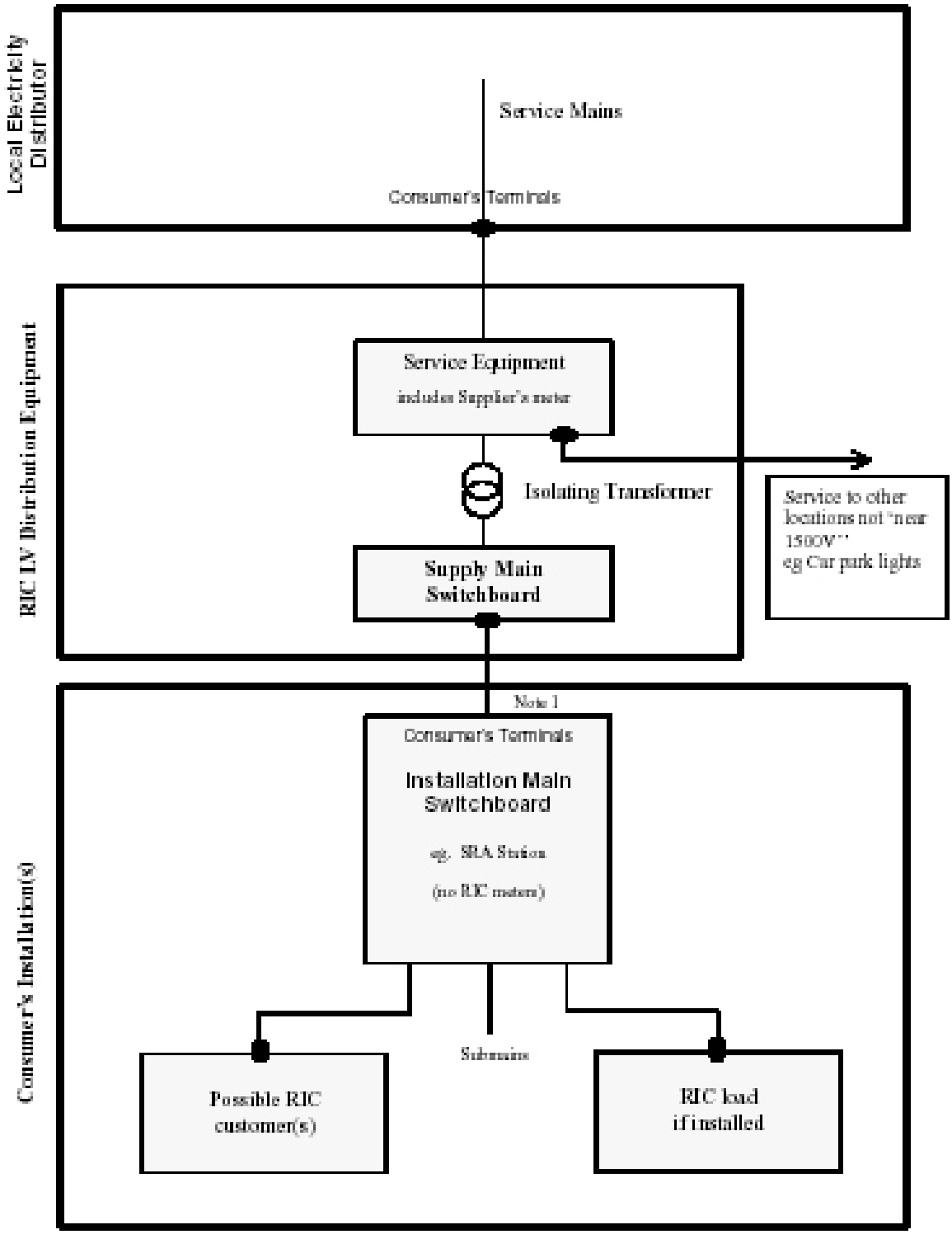


Figure 2 – Connection to Local Distributor only



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

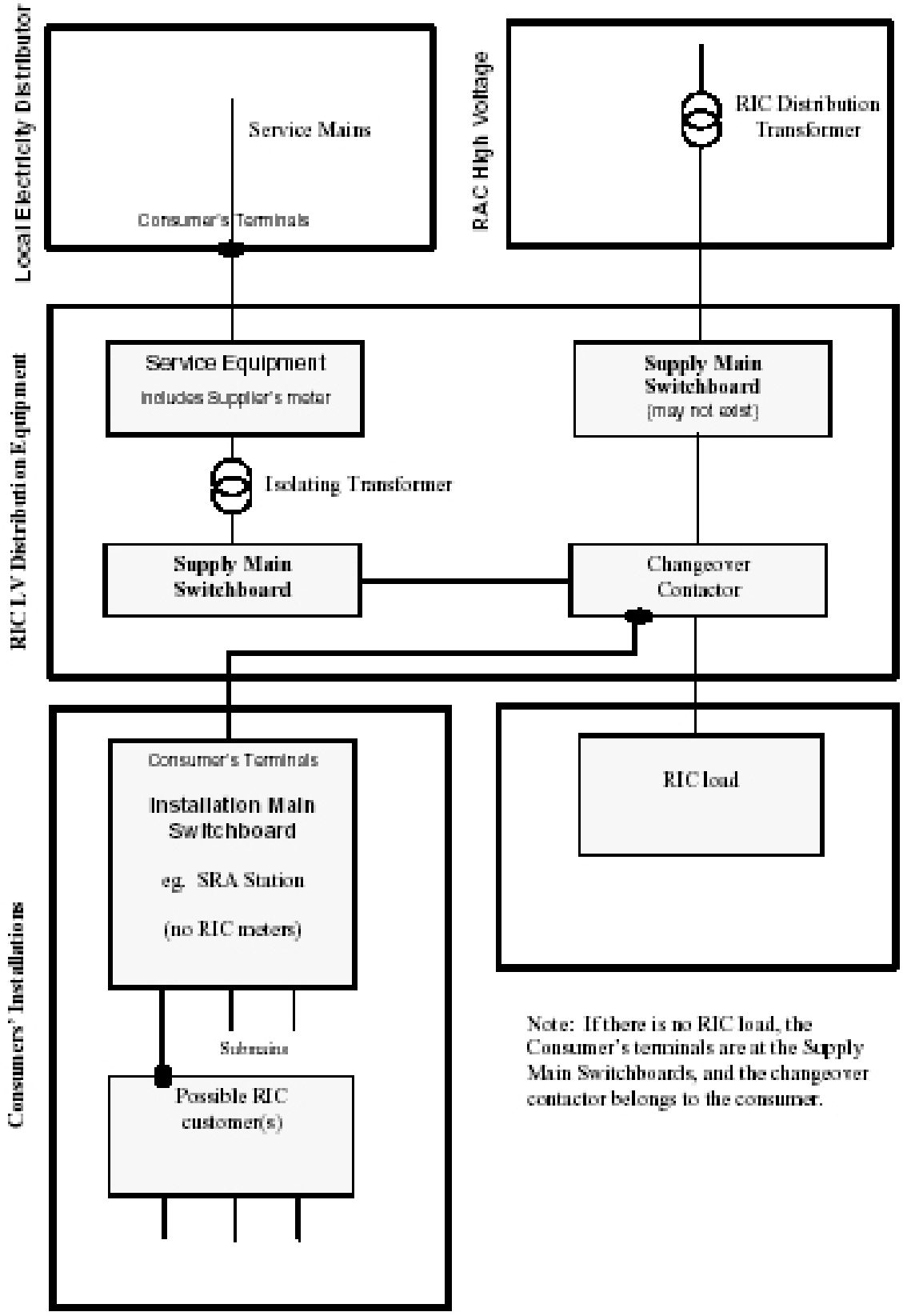


Figure 4a – Two changeover contactors and one Local Distributor connection – future for competitive market

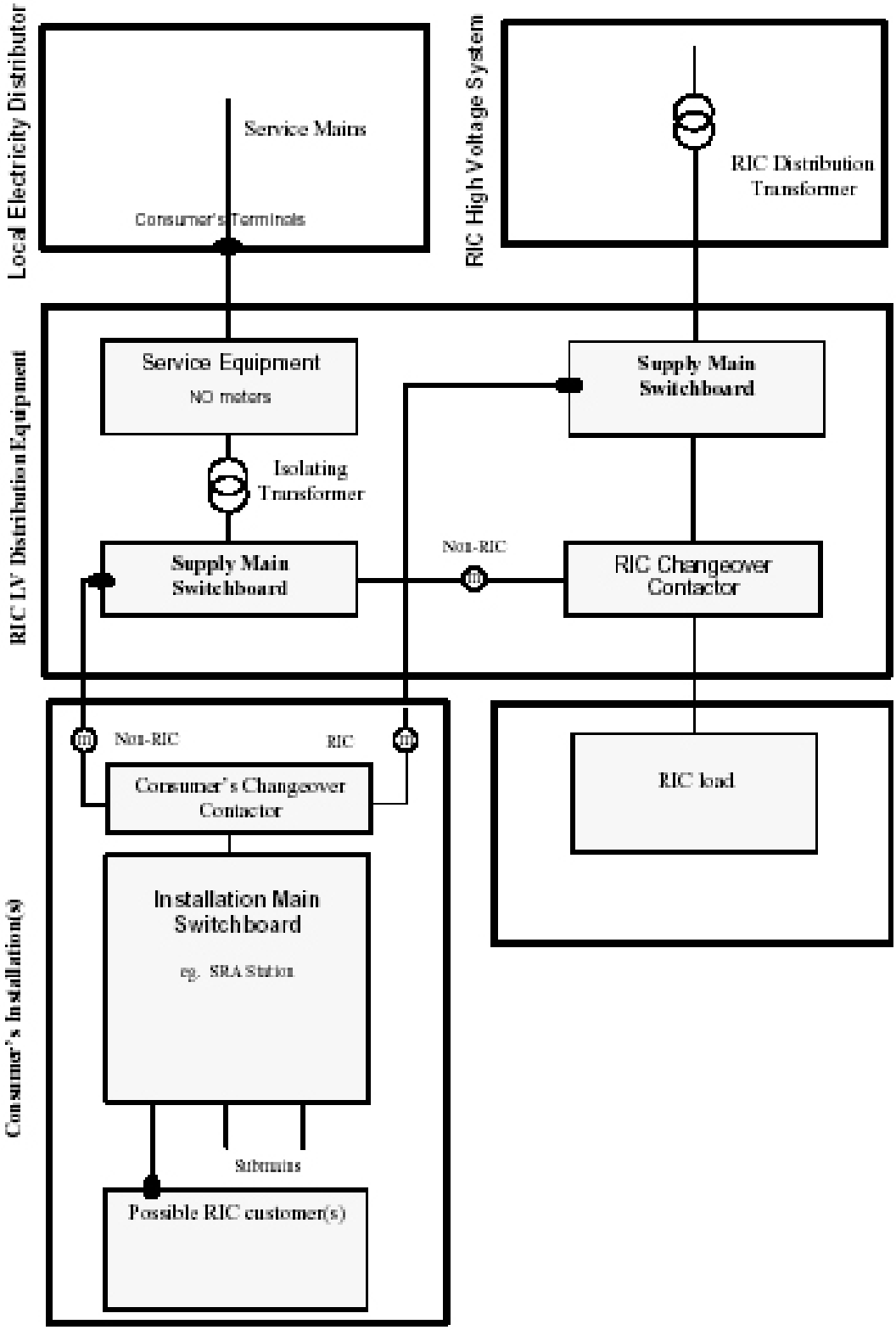


Figure 4b - Two changeover contactors and one Local Distributor connection – existing, non- preferred

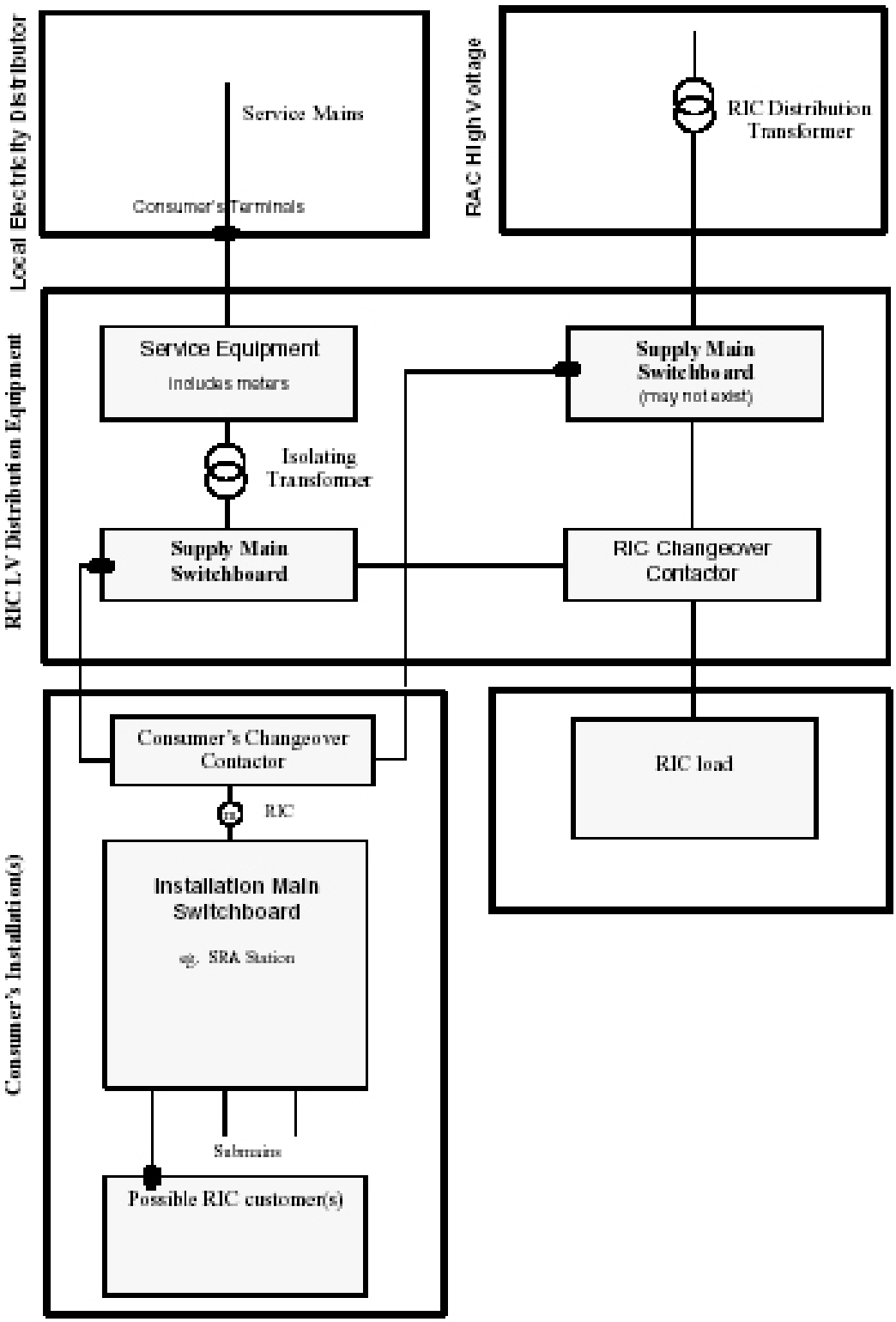


Figure 5 – Two changeover contactors and two Local Distributor connections

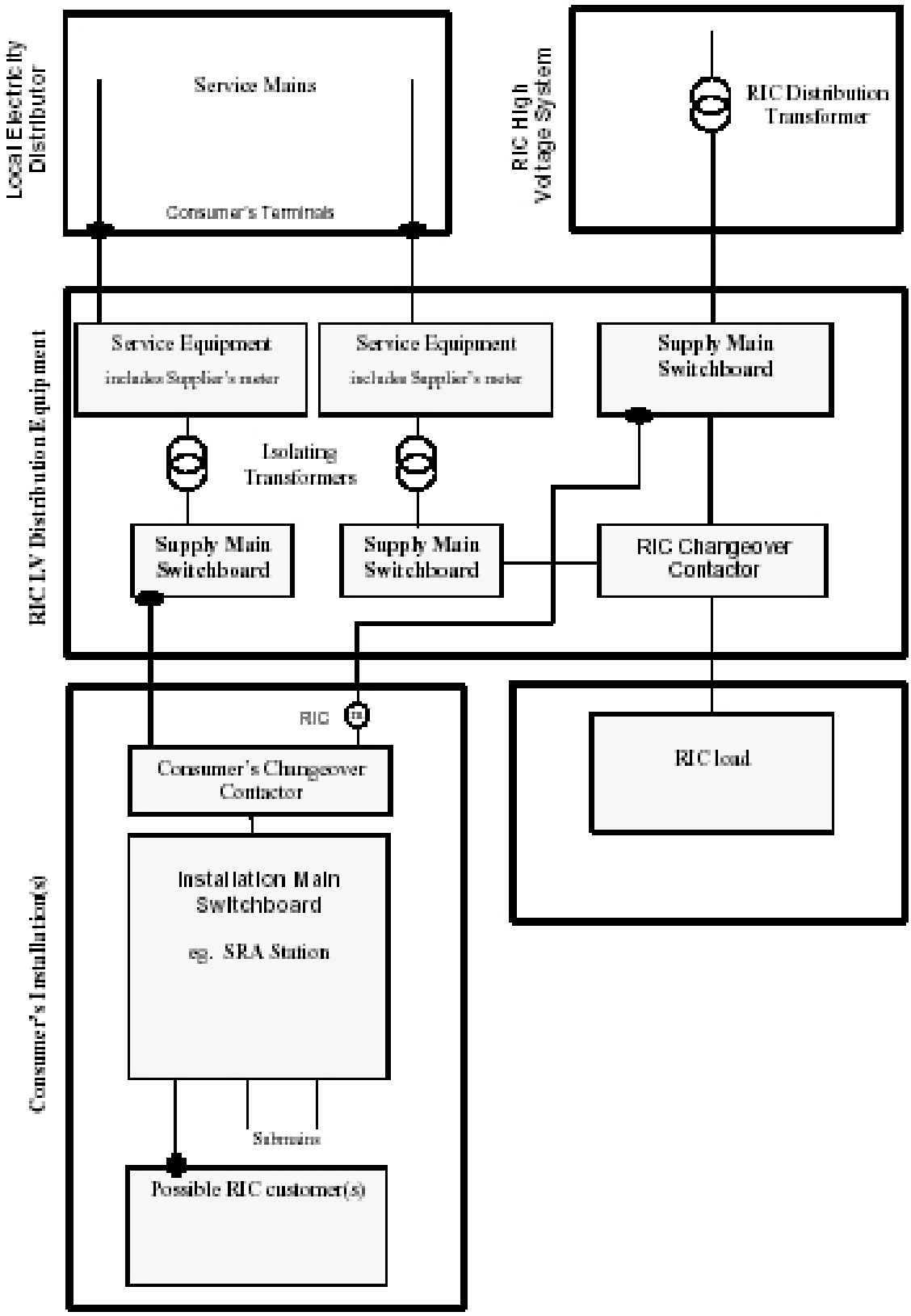
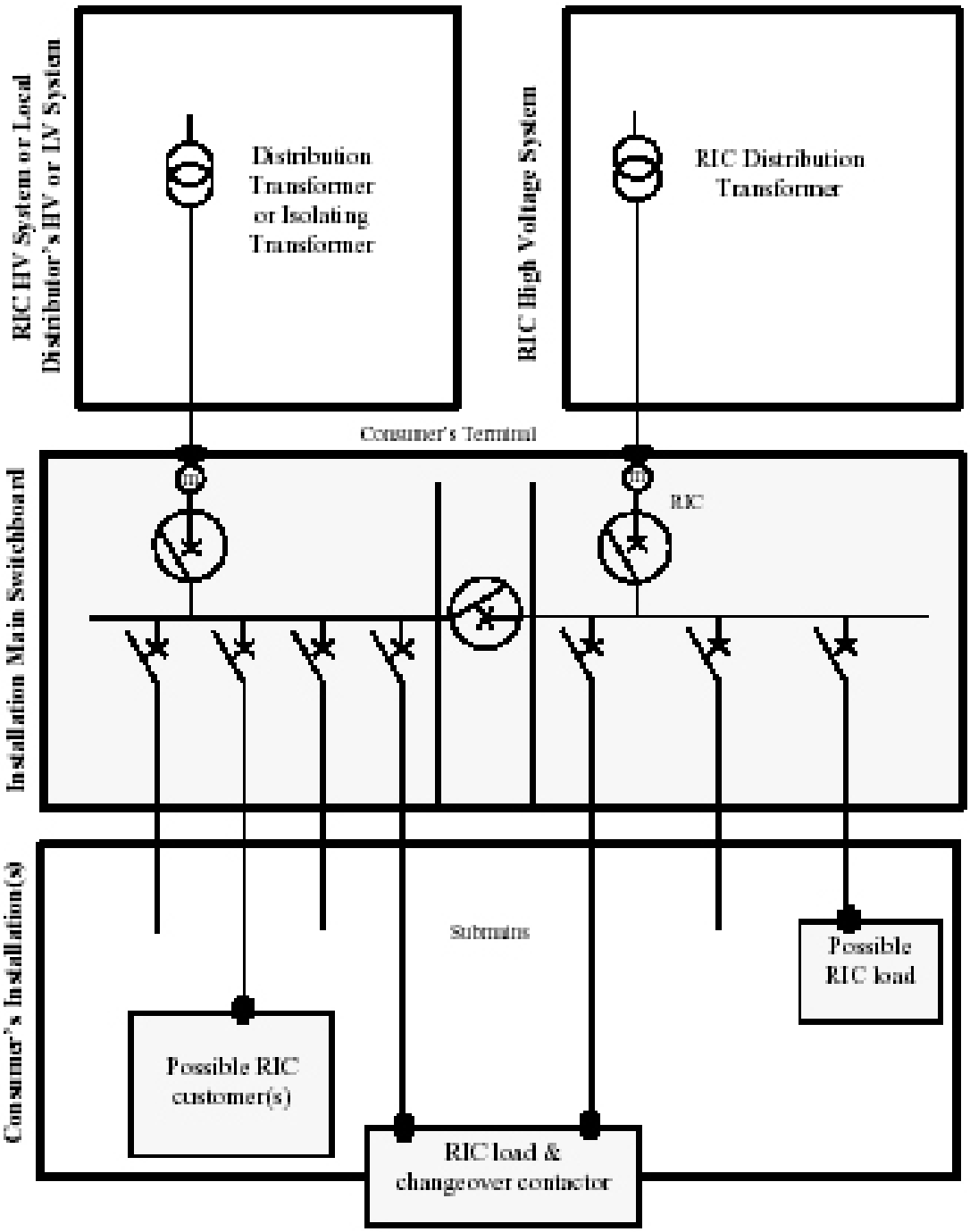


Figure 6 - Major 415V board – existing, non-preferred



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

Figure 7 – Major 415V board – preferred