

**THIS FOLDER WAS CHECKED BY
ARUP ON**

21.3.03

**The checking process was to ensure that 3 identical
sets of each Volume of the Operating and
Maintenance Manuals existed**

**5-7 CARLTON GARDENS
LONDON SW1**

**OPERATING & MAINTENANCE
INSTRUCTIONS
for the
ELECTRICAL SERVICES**

**VOLUME 3
3.3.1 – Section H (H1)**

*Collated By :
Commissioning Management Ltd
5, St Peters Court
Colchester
Essex
CO1 1WD*

*Tel : 01206 761911
Fax : 01206 761932*

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ITEM	GENERAL OPERATING INSTRUCTIONS	GENERAL MAINTENANCE INSTRUCTIONS	SPECIFIC SUPPLIER LITERATURE
FIRE ALARM SYSTEM & DETECTION & VOICE ALARM I.A.T. (Europe) Ltd.	D.1.3	E.1.7, E.1.2.1, E.1.3, E.1.5, E.2, E.3, E.7.3.1	H.8
STANDBY GENERATION AVK/SEG (UK) Ltd.	D.1.2, D.2, D.3, D4	E.1.2.1, E.1.3, E.1.5, E.2, E.3, E.7.1, E.7.1.1, E.7.1.2, E.7.1.3	H.3
L.V SWITCHGEAR & DIST. BOARDS (Anord Control Systems Ltd.)	D.1.1	E.1.1, E.1.2.1, E.1.3, E.1.5, E.2, E.3, E.7.1, E.7.1.1, E.7.1.2, E.7.1.3	H.1
SECURITY SYSTEM Blenheim Security Systems Ltd.	D.1.4	E.1.2.1, E.1.3, E.1.5, E.2, E.3, H.6	H.6

1

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TECHNICAL DATA

Recommendations for Switchgear and Plant Maintenance

Scope

This document sets out recommendations for the on-site maintenance of switchgear and controlgear manufactured by Anord.

The document does not cover final circuit testing, which is subject to the provisions of the *Regulations for Electrical Installations*, current edition.

General

After commissioning, regular maintenance should be carried out on the switchgear, the frequency of which is determined by the application, environment and age. Notwithstanding the requirement for regular maintenance, all busbar joints and power connections must be inspected one year after commissioning and subsequently at each maintenance interval.

All switchgear maintenance should be carried out in accordance with BS 6423, *Code of practice for maintenance of electrical switchgear and controlgear for voltages up to and including 1 kV*.

SAFETY

Working on electrical equipment is a potentially dangerous operation and must only be undertaken by suitably qualified and experienced personnel who are familiar with the operation of the equipment.

The switchgear must be isolated, locked off and earthed before beginning any maintenance work. However, ON NO ACCOUNT must it be assumed that isolation and earthing has made all conductors dead. Therefore, before working on any electrical equipment or conductors, a positive check must be made that it is not live, by using a phase tester, voltmeter or other suitable test equipment. All such test equipment must be checked to be operational before being used in such an application.

Any necessary protective clothing must be worn and any protective equipment must be used.

Where the Customer's plant requires special safety procedures, then these must be observed at all times.

A Permit to Work system may be considered.

Removing Plant from Service

No switchgear panel should be taken out of service for maintenance without the prior consent of operational staff. Prior to maintenance, it is essential that all plant that may be affected by a

shutdown is identified and this must be communicated to and agreed with operational staff. Where the switchgear assembly supplies high-integrity plant or plant which must operate continuously, then backup supplies must be in place before isolation of any switchgear takes place.

Recommendations for Regular Maintenance

Recommended Intervals for Regular Maintenance

The maximum recommended period for regular maintenance of the switchgear is as follows.

Application	Maintenance Interval
Indoor switchgear and earthing systems	3 to 7 years
Distribution switchgear	5 years
Protection equipment	5 years
Measurement equipment	5 years
Installations where faults could cause exceptional risk (e.g. shopping centres, restaurants, etc.)	3 years

Unusual site conditions or switchgear applications may require more frequent maintenance and should be taken into account when planning maintenance.

Maintenance Plans and Records

Maintenance Plans and Logs should be established for each switchgear assembly. The Maintenance Plans should detail the required maintenance intervals and should list the maintenance procedures to be carried out.

Maintenance Log entries should be completed at each maintenance operation. Details of the maintenance operations carried out and any problems or faults detected should be recorded to assist future maintenance.

Maintenance of Electrical Switchgear

Busbars and Connections

- Barriers and insulators should be examined, as far as is reasonable practicable, for cracks or evidence of tracking or loose fixings.
- Connections should be checked for tightness and evidence of overheating or corrosion. They should be retorqued where necessary. Busbar joints and all connections should be inspected one year after commissioning and at each maintenance period thereafter.
- Busbar compartments should be cleaned and checked for loose wiring or equipment before being closed up.
- When busbar chamber maintenance has been carried out, the busbar lids should be closed and torqued to 1 Nm.

Withdrawable Switchgear

If the switchgear consists of removable parts or withdrawable cassettes, the condition of the contacts should be checked after approximately 20 withdrawals. Checks should include:

- Spring tension
- Contact cleanliness
- Evidence of overheating

- Evidence of corrosion

Once the contact has been checked and cleaned it should be regreased using petroleum jelly.

Automatic shutters for withdrawable components should be checked for correct and effective operation.

Metalwork

All metalwork should be cleaned and inspected for paintwork damage and/or corrosion. Where necessary, the paintwork should be repaired as follows:

1. Remove loose paint and/or rust.
2. Clean using a wire brush or sandpaper.
3. Paint with UROALKYD touch-up paint of the required colour.

Mechanical Interlocks

The following should be carried out:

- Door locks and hinges should be checked for operation and tightness.
- Operating handle interlocks should be checked for correct operation.
- All equipotential bonding conductors to doors and hinged apparatus should be checked for continuity.
- Any mechanical interlock systems used on main incoming feeders etc. should be checked for correct operation.

Note

It is important that a full understanding is achieved of the requirements of the interlock system and its operation before maintenance is undertaken.

Wiring

The following should be carried out:

- All wiring, in particular equipotential and supplementary bonding conductors, should be checked for continuity, security of termination and for evidence of mechanical/thermal damage or corrosion.
- In particular, all circuit protective conductors to removable equipment should be checked for terminal tightness.
- Circuit protective conductors must be reconnected and retested when the associated equipment is refitted after having been removed or withdrawn for maintenance or repair.

Shrouds and Screens

The following should be carried out:

- All shrouds and screens should be cleaned.
- Shrouds and screens should be checked that they are securely fitted. If they are removed for maintenance purposes then they should be refitted.
- Shrouds and screens should be checked for breakages.
- Broken or missing shrouds and screens should be replaced.

Labels

All labels, particularly warning labels, should be checked that they are securely fitted. Where missing, they should be replaced.

Components

All components should be checked and maintained in accordance with the manufacturer's instructions as detailed in the components brochures.

Components to be checked should include protection and control relays, main load breaking devices, overloads and terminals. Equipment which has variable settings (e.g. timers, protection relays, etc.) should have these settings checked against tabulated records.

Control and Instrumentation Systems

Control Circuits

The following should be carried out, where applicable:

- Control circuitry should be fully checked to ensure correct operation in accordance with control schematics. In particular, high-integrity and safety circuits should be thoroughly checked.
- Equipment which has variable settings (e.g. timers, protection relays, etc.) should have these settings checked against tabulated records.
- Indicating lamps should be checked as operational and replaced where faulty.
- Anti-condensation heaters and ventilation equipment should be checked for correct operation.
- Electronic equipment should be checked in accordance with the manufacturer's recommendations as detailed in the equipment brochures.
- Any modifications to the control system should be documented and any drawings updated accordingly.

Programmable Logic Controllers (PLCs) and Other Electronic Equipment

The following should be carried out:

- PLCs are normally equipped with battery backup which should be checked for failure at regular intervals as specified by the manufacturer. Failed batteries should be replaced.
- PLC cards should be inspected for wiring integrity.
- On-board clocks should be checked for drift and reset to the correct time.
- All electronic equipment should be checked for signs of abnormal heating.

Instrumentation

The following should be carried out:

- Process instrumentation such as flowmeters, chemical sensors, etc. should be tested in accordance with the manufacturer's instructions and recommendations.
- In particular, calibration settings should be verified. This applies to primary instrumentation transmitters and sensors and to any signal conditioning/conversion equipment installed on instrumentation loops.
- The operation of visual indicating equipment should be verified and, where applicable, checked for accuracy.
- Sensors which are in contact with process fluids or gases should be checked for leakage and corrosion.
- All equipment which operates in the presence of chemicals should be checked for corrosion.
- Warning and alarm systems should be thoroughly checked. In particular, alarm setpoints should be calibrated and audible and visual warning devices should be positively verified by, where possible, forcing the system into an alarm state.

Actuators

Actuators such as valves should be checked for correct operation. The actuator mechanisms should be checked for wear and tear. Where actuators require regular cleaning, greasing, etc. then this should be carried out at the manufacturer's recommended intervals.

Cleaning

When the switchgear maintenance has been completed, the switchgear should be fully cleaned out to remove any dust, debris or tools.

The spare components stock should be replenished where applicable.

2

INSPECTION / TEST CERTIFICATE 4858



PROJECT TITLE 5-7 CARLTON GARDENS SUB NO. 558 TEST DATE 1-10-98

PANEL TITLE DB3/t1

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 42 SHORT CIRCUIT RATING 16 kA VOLTAGE 415

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0297/10031

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 94120017411294 SERIAL NO 368061001696

1000V MEGGER TEST 2

SERIAL NO 94120017411294

10A DUCTOR TEST

SERIAL NO _____

INSULATION RESISTANCE

R/S	<u>7999</u>	MΩ	R/S	<u>0.1</u>	mA
S/T	<u>7999</u>	MΩ	S/T	<u>0.1</u>	mA
T/R	<u>7999</u>	MΩ	T/R	<u>0.1</u>	mA
R/N	<u>7999</u>	MΩ	R/N	<u>0.1</u>	mA
S/N	<u>7999</u>	MΩ	S/N	<u>0.1</u>	mA
T/N	<u>7999</u>	MΩ	T/N	<u>0.1</u>	mA
R/E	<u>7999</u>	MΩ	R/E	<u>0.1</u>	mA
S/E	<u>7999</u>	MΩ	S/E	<u>0.1</u>	mA
T/E	<u>7999</u>	MΩ	T/E	<u>0.1</u>	mA
N/E	<u>7999</u>	MΩ	N/E	<u>0.1</u>	mA

INSULATION RESISTANCE

R/S	<u>7999</u>	MΩ	R/S	<u>7999</u>	MΩ
S/T	<u>7999</u>	MΩ	S/T	<u>7999</u>	MΩ
T/R	<u>7999</u>	MΩ	T/R	<u>7999</u>	MΩ
R/N	<u>7999</u>	MΩ	R/N	<u>7999</u>	MΩ
S/N	<u>7999</u>	MΩ	S/N	<u>7999</u>	MΩ
T/N	<u>7999</u>	MΩ	T/N	<u>7999</u>	MΩ
R/E	<u>7999</u>	MΩ	R/E	<u>7999</u>	MΩ
S/E	<u>7999</u>	MΩ	S/E	<u>7999</u>	MΩ
T/E	<u>7999</u>	MΩ	T/E	<u>7999</u>	MΩ
N/E	<u>7999</u>	MΩ	N/E	<u>7999</u>	MΩ

BUSBAR RESISTANCE

R	<input type="checkbox"/>	mΩ
S	<input type="checkbox"/>	mΩ
T	<input type="checkbox"/>	mΩ
N	<input type="checkbox"/>	mΩ
E	<input type="checkbox"/>	mΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING

ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT

L+N/E MΩ L+N/E mA

INSULATION RESISTANCE

L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TEC Graham Day WITNESS _____ DRAWING NO 558/S1/1

RELEASED Stephen Murphy RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4857

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 29-9-98

PANEL TITLE DB 5/1T1

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
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WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 42 SHORT CIRCUIT RATING 16KA VOLTAGE 415

SAFETY SCREENING PAINT. WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0297/10031

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 94120017411294 SERIAL NO 368CE1001696

1000V MEGGER TEST 2

SERIAL NO 94120017411294 SERIAL NO _____

10A DUCTOR TEST

INSULATION RESISTANCE		LEAKAGE CURRENT		INSULATION RESISTANCE		BUSBAR RESISTANCE	
R/S	<u>2999</u> mΩ	R/S	<u>0.1</u> mA	R/S	<u>2999</u> mΩ	R	<input type="text"/> mΩ
S/T	<u>2999</u> mΩ	S/T	<u>0.1</u> mA	S/T	<u>2999</u> mΩ	S	<input type="text"/> mΩ
T/R	<u>>999</u> mΩ	T/R	<u>0.1</u> mA	T/R	<u>2999</u> mΩ	T	<input type="text"/> mΩ
R/N	<u>2999</u> mΩ	R/N	<u>0.1</u> mA	R/N	<u>2999</u> mΩ	N	<input type="text"/> mΩ
S/N	<u>2999</u> mΩ	S/N	<u>0.1</u> mA	S/N	<u>2999</u> mΩ	E	<input type="text"/> mΩ
T/N	<u>2999</u> mΩ	T/N	<u>0.1</u> mA	T/N	<u>2999</u> mΩ	NOTE: RESISTANCE MEASURED ACROSS EXTREME ENDS OF EACH BUSBAR	
R/E	<u>2999</u> mΩ	R/E	<u>0.1</u> mA	R/E	<u>2999</u> mΩ		
S/E	<u>2999</u> mΩ	S/E	<u>0.1</u> mA	S/E	<u>2999</u> mΩ		
T/E	<u>2999</u> mΩ	T/E	<u>0.1</u> mA	T/E	<u>2999</u> mΩ		
N/E	<u>2999</u> mΩ	N/E	<u>0.1</u> mA	N/E	<u>2999</u> mΩ		

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE
L+N/E mΩ L+N/E mA L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED S. Darby WITNESS _____ DRAWING NO 558/411/1

RELEASED S. Murphy RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4865

PROJECT TITLE 5-7 CARLTON GARDEN JOB NO. 558/E1 TEST DATE 1/10/98

PANEL TITLE LANDLORD G/L1 & G/EL1

CLIENT I. PARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
WORKS	SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING N/A VOLTAGE 215

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORSION WRENCH SERIAL NO 0297/10031

ELCTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO 9412001741

SERIAL NO 36806/0010696

SERIAL NO 9412001741

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S	<u>>999</u>	MΩ	R/S	<u>0.2</u>	mA	R/S	<u>>999</u>	MΩ	R	<u>—</u>	mΩ
S/T	<u>>999</u>	MΩ	S/T	<u>0.2</u>	mA	S/T	<u>>999</u>	MΩ	S	<u>—</u>	mΩ
T/R	<u>>999</u>	MΩ	T/R	<u>0.2</u>	mA	T/R	<u>>999</u>	MΩ	T	<u>—</u>	mΩ
R/N	<u>>999</u>	MΩ	R/N	<u>0.1</u>	mA	R/N	<u>>999</u>	MΩ	N	<u>—</u>	mΩ
S/N	<u>>999</u>	MΩ	S/N	<u>0.1</u>	mA	S/N	<u>>999</u>	MΩ	E	<u>—</u>	mΩ
T/N	<u>>999</u>	MΩ	T/N	<u>0.1</u>	mA	T/N	<u>>999</u>	MΩ			
R/E	<u>>999</u>	MΩ	R/E	<u>0.1</u>	mA	R/E	<u>>999</u>	MΩ			
S/E	<u>>999</u>	MΩ	S/E	<u>0.1</u>	mA	S/E	<u>>999</u>	MΩ			
T/E	<u>>999</u>	MΩ	T/E	<u>0.1</u>	mA	T/E	<u>>999</u>	MΩ			
N/E	<u>>999</u>	MΩ	N/E	<u>0.1</u>	mA	N/E	<u>>999</u>	MΩ			

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

L+N/E MΩ

L+N/E mA

L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

N/A

PROTECTION DEVICES

PLC N/A

VSD N/A

SOFTSTARTS N/A

OTHER

COMMENTS 6 N° 1C16 MCBs TO BE FITTED

1 N° 1C2 MCB TO BE FITTED

TESTED P Duffy

WITNESS _____

DRAWING NO 558/E1

RELEASED Steph Whitley

RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4856

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 29-9-98

PANEL TITLE L/LORD 7/EL1 + 7/L1 GENERAL ARRANGEMENT

CLIENT T. CLARKE PLC INSPECTION / TEST AT WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 42 SHORT CIRCUIT RATING 16KA VOLTAGE 415

SAFETY SCREENING PAINT. WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORSION WRENCH SERIAL NO 0297/10031

TRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST 1000V MEGGER TEST 2 10A DUCTOR TEST
SERIAL NO 94120017411294 SERIAL NO 3680610010896 SERIAL NO 94120017411294 SERIAL NO _____

INSULATION RESISTANCE	LEAKAGE CURRENT	INSULATION RESISTANCE	BUSBAR RESISTANCE
R/S <u>>999</u> mΩ	R/S <u>0.1</u> mA	R/S <u>>999</u> mΩ	R <input type="checkbox"/> mΩ
S/T <u>>999</u> mΩ	S/T <u>0.1</u> mA	S/T <u>>999</u> mΩ	S <input type="checkbox"/> mΩ
T/R <u>>999</u> mΩ	T/R <u>0.1</u> mA	T/R <u>>999</u> mΩ	T <input type="checkbox"/> mΩ
R/N <u>>999</u> mΩ	R/N <u>0.1</u> mA	R/N <u>>999</u> mΩ	N <input type="checkbox"/> mΩ
S/N <u>>999</u> mΩ	S/N <u>0.1</u> mA	S/N <u>>999</u> mΩ	E <input type="checkbox"/> mΩ
T/N <u>>999</u> mΩ	T/N <u>0.1</u> mA	T/N <u>>999</u> mΩ	
R/E <u>>999</u> mΩ	R/E <u>0.1</u> mA	R/E <u>>999</u> mΩ	NOTE: RESISTANCE MEASURED
S/E <u>>999</u> mΩ	S/E <u>0.1</u> mA	S/E <u>>999</u> mΩ	ACROSS EXTREME ENDS OF
T/E <u>>999</u> mΩ	T/E <u>0.1</u> mA	T/E <u>>999</u> mΩ	EACH BUSBAR
N/E <u>>999</u> mΩ	N/E <u>0.1</u> mA	N/E <u>>999</u> mΩ	

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE
L+N/E mΩ L+N/E mA L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED Graham Darby WITNESS _____ DRAWING NO 558/m/2
RELEASED Steve Murphy RELEASE DATE 6/10/98
QUALITY / PRODUCTION / INSPECTION /

INSPECTION / TEST CERTIFICATE 4861

PROJECT TITLE 5-7 CARLTON GARDEN'S JOB NO. 558 TEST DATE 1-10-98

PANEL TITLE DB 4/1/1

CLIENT T CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
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WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 42 SHORT CIRCUIT RATING 16KA VOLTAGE 515

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0297/10031

ELCTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST 1000V MEGGER TEST 2 10A DUCTOR TEST

SERIAL NO 44120017411294 SERIAL NO 368061001696 SERIAL NO 94120017411294 SERIAL NO _____

INSULATION RESISTANCE	LEAKAGE CURRENT	INSULATION RESISTANCE	BUSBAR RESISTANCE
R/S <u>>999</u> MΩ	R/S <u>0.1</u> mA	R/S <u>>999</u> MΩ	R <input checked="" type="checkbox"/> mΩ
S/T <u>>999</u> MΩ	S/T <u>0.1</u> mA	S/T <u>>999</u> MΩ	S <input checked="" type="checkbox"/> mΩ
T/R <u>>999</u> MΩ	T/R <u>0.1</u> mA	T/R <u>>999</u> MΩ	T <input checked="" type="checkbox"/> mΩ
R/N <u>>999</u> MΩ	R/N <u>0.1</u> mA	R/N <u>>999</u> MΩ	N <input checked="" type="checkbox"/> mΩ
S/N <u>>999</u> MΩ	S/N <u>0.1</u> mA	S/N <u>>999</u> MΩ	E <input checked="" type="checkbox"/> mΩ
T/N <u>>999</u> MΩ	T/N <u>0.1</u> mA	T/N <u>>999</u> MΩ	
R/E <u>>999</u> MΩ	R/E <u>0.1</u> mA	R/E <u>>999</u> MΩ	
S/E <u>>999</u> MΩ	S/E <u>0.1</u> mA	S/E <u>>999</u> MΩ	
T/E <u>>999</u> MΩ	T/E <u>0.1</u> mA	T/E <u>>999</u> MΩ	
N/E <u>>999</u> MΩ	N/E <u>0.1</u> mA	N/E <u>>999</u> MΩ	

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE L+N/E MΩ LEAKAGE CURRENT L+N/E mA INSULATION RESISTANCE L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED J. Ham D. Dwyer WITNESS _____ DRAWING NO. 558/T/

RELEASED S. Murphy RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4859

PROJECT TITLE 5-7 CARLTON GARDENS SUB NO. 558 TEST DATE 1-10-98

PANEL TITLE DB4/T2

CLIENT T CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
WORKS	SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 42 SHORT CIRCUIT RATING 16KA VOLTAGE 415

SAFETY SCREENING PAINT. WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0297/10031

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 94/20017411294 SERIAL NO 368061001696

1000V MEGGER TEST 2

SERIAL NO 94/20017411294 SERIAL NO _____

10A DUCTOR TEST

INSULATION RESISTANCE

R/S	<u>7999</u>	MΩ	R/S	<u>0.1</u>	mA
S/T	<u>7999</u>	MΩ	S/T	<u>0.1</u>	mA
T/R	<u>7999</u>	MΩ	T/R	<u>0.1</u>	mA
R/N	<u>7999</u>	MΩ	R/N	<u>0.1</u>	mA
S/N	<u>7999</u>	MΩ	S/N	<u>0.1</u>	mA
T/N	<u>7999</u>	MΩ	T/N	<u>0.1</u>	mA
R/E	<u>7999</u>	MΩ	R/E	<u>0.1</u>	mA
S/E	<u>7999</u>	MΩ	S/E	<u>0.1</u>	mA
T/E	<u>7999</u>	MΩ	T/E	<u>0.1</u>	mA
N/E	<u>7999</u>	MΩ	N/E	<u>0.1</u>	mA

INSULATION RESISTANCE

R/S	<u>7999</u>	MΩ	R/S	<u>7999</u>	MΩ
S/T	<u>7999</u>	MΩ	S/T	<u>7999</u>	MΩ
T/R	<u>7999</u>	MΩ	T/R	<u>7999</u>	MΩ
R/N	<u>7999</u>	MΩ	R/N	<u>7999</u>	MΩ
S/N	<u>7999</u>	MΩ	S/N	<u>7999</u>	MΩ
T/N	<u>7999</u>	MΩ	T/N	<u>7999</u>	MΩ
R/E	<u>7999</u>	MΩ	R/E	<u>7999</u>	MΩ
S/E	<u>7999</u>	MΩ	S/E	<u>7999</u>	MΩ
T/E	<u>7999</u>	MΩ	T/E	<u>7999</u>	MΩ
N/E	<u>7999</u>	MΩ	N/E	<u>7999</u>	MΩ

BUSBAR RESISTANCE

R	<input type="checkbox"/>	mΩ
S	<input type="checkbox"/>	mΩ
T	<input type="checkbox"/>	mΩ
N	<input type="checkbox"/>	mΩ
E	<input type="checkbox"/>	mΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E MΩ L+N/E mA

INSULATION RESISTANCE

L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A

POWER CIRCUIT CONTINUITY

INSTRUMENTATION N/A

PROTECTION DEVICES

PLC N/A

VSD N/A

SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED

Graham Denby

WITNESS

DRAWING NO 558/t2/2

RELEASED

Steve Murphy

RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4860

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 1-10-98
PANEL TITLE LANDLORD 5/ELI + 5/KI
CLIENT T. CLARKE PLC. INSPECTION / TEST AT
WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 42 SHORT CIRCUIT RATING 16KA VOLTAGE 415

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0297/10031

ELCTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 94120017411244, SERIAL NO 368061001696

1000V MEGGER TEST 2

SERIAL NO 94120017411244, SERIAL NO _____

10A DUCTOR TEST

INSULATION RESISTANCE	LEAKAGE CURRENT	INSULATION RESISTANCE	BUSBAR RESISTANCE
R/S <u>7999</u> MΩ	R/S <u>0.1</u> mA	R/S <u>7999</u> MΩ	R <input type="checkbox"/> mΩ
S/T <u>7999</u> MΩ	S/T <u>0.1</u> mA	S/T <u>>999</u> MΩ	S <input type="checkbox"/> mΩ
T/R <u>7999</u> MΩ	T/R <u>0.1</u> mA	T/R <u>7999</u> MΩ	T <input type="checkbox"/> mΩ
R/N <u>7999</u> MΩ	R/N <u>0.1</u> mA	R/N <u>7999</u> MΩ	N <input type="checkbox"/> mΩ
S/N <u>7999</u> MΩ	S/N <u>0.1</u> mA	S/N <u>7999</u> MΩ	E <input type="checkbox"/> mΩ
T/N <u>7999</u> MΩ	T/N <u>0.1</u> mA	T/N <u>7999</u> MΩ	
R/E <u>7999</u> MΩ	R/E <u>0.1</u> mA	R/E <u>7999</u> MΩ	
S/E <u>7999</u> MΩ	S/E <u>0.1</u> mA	S/E <u>7999</u> MΩ	
T/E <u>7999</u> MΩ	T/E <u>0.1</u> mA	T/E <u>7999</u> MΩ	
N/E <u>7999</u> MΩ	N/E <u>0.1</u> mA	N/E <u>7999</u> MΩ	

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE
L+N/E MΩ L+N/E mA L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED Graham Dandy WITNESS _____ DRAWING NO 558/11/2.
RELEASED Stephen Murphy RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4855

PROJECT TITLE 5-7 CARLTON GARDENS NO. 558 TEST DATE 29-9-98

PANEL TITLE DBS/T2 GENERAL ARRANGEMENT

CLIENT J CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
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WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION 200A

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING 16KA VOLTAGE 415V

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORSION WRENCH SERIAL NO 0297/10031

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 94120017411294 SERIAL NO 3680610010696

1000V MEGGER TEST 2

SERIAL NO 94120017411294 SERIAL NO _____

10A VOLTMETER TEST

INSULATION RESISTANCE

R/S 7999 MΩ R/S 0.1 mA

S/T 7999 MΩ S/T 0.1 mA

T/R 7999 MΩ T/R 0.1 mA

R/N 7999 MΩ R/N 0.1 mA

S/N 7999 MΩ S/N 0.1 mA

T/N 7999 MΩ T/N 0.1 mA

R/E 7999 MΩ R/E 0.1 mA

S/E 7999 MΩ S/E 0.1 mA

T/E 7999 MΩ T/E 0.1 mA

N/E 7999 MΩ N/E 0.1 mA

INSULATION RESISTANCE

R/S 7999 MΩ

S/T 7999 MΩ

T/R 7999 MΩ

R/N 7999 MΩ

S/N 7999 MΩ

T/N 7999 MΩ

R/E 7999 MΩ

S/E 7999 MΩ

T/E 7999 MΩ

N/E 7999 MΩ

BUSBAR RESISTANCE

R mΩ

S mΩ

T mΩ

N mΩ

E mΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING

ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E MΩ

LEAKAGE CURRENT

L+N/E mA

INSULATION RESISTANCE

L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED Graham Daby WITNESS _____ DRAWING NO 558/42/2
RELEASED Stephen Murphy RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4767

PROJECT TITLE S-7 Carlton Gardens JOB NO. 558 TEST DATE 29/9/98

PANEL TITLE B/EL4, B/ELS, G/EL2, 7R4, 7/R1

CLIENT T. CLARKE PLC INSPECTION / TEST AT

WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 35 SHORT CIRCUIT RATING 16kA/5s VOLTAGE 400V

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO 9609331092

SERIAL NO

7

SERIAL NO 9609331032

SERIAL NO

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S > 999 mΩ

R/S mA

R/S > 999 mΩ

R mΩ

S/T > 999 mΩ

S/T mA

S/T > 999 mΩ

S mΩ

T/R > 999 mΩ

T/R N mA

T/R > 999 mΩ

T mΩ

R/N > 999 mΩ

R/N mA

R/N > 999 mΩ

N mΩ

S/N > 999 mΩ

S/N mA

S/N > 999 mΩ

E mΩ

T/N > 999 mΩ

T/N A mA

T/N > 999 mΩ

R/E > 999 mΩ

R/E mA

R/E > 999 mΩ

S/E > 999 mΩ

S/E mA

S/E > 999 mΩ

T/E > 199 mΩ

T/E mA

T/E > 999 mΩ

N/E > 999 mΩ

N/E mA

N/E > 999 mΩ

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

L+N/E mΩ

L+N/E mA

L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

PROTECTION DEVICES RCD

PLC

VSD

SOFTSTARTS

OTHER

COMMENTS Megger readings the same for all above panels

TESTED FRallato

WITNESS

M.Parker

DRAWING NO

RELEASED Steph Wby

RELEASE DATE 2/10/98

INSPECTION / TEST CERTIFICATE 4768

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 30/9/98

PANEL TITLE 7/R3, 6/R5, B/E23, 6/R6, 6/R2,

CLIENT T. CLARKS PLC INSPECTION / TEST AT

WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 35 SHORT CIRCUIT RATING 11KA/1sec VOLTAGE 400V

SAFETY SCREENING PAINT. WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

SERIAL NO 960933/092

2.5KV FLASHTEST

SERIAL NO _____

1000V MEGGER TEST 2

SERIAL NO 960933/092

10A DUCTOR TEST

SERIAL NO _____

INSULATION RESISTANCE

R/S > 999 mΩ

LEAKAGE CURRENT

R/S mA

S/T > 999 mΩ

S/T mA

T/R > 999 mΩ

T/R mA

R/N > 999 mΩ

R/N mA

S/N > 999 mΩ

S/N mA

T/N > 999 mΩ

T/N mA

R/E > 999 mΩ

R/E mA

S/E > 999 mΩ

S/E mA

T/E > 999 mΩ

T/E mA

N/E > 999 mΩ

N/E mA

INSULATION RESISTANCE

R/S > 999 mΩ

BUSBAR RESISTANCE

R mΩ

S/T > 999 mΩ

S mΩ

T/R > 999 mΩ

T mΩ

R/N > 999 mΩ

N mΩ

S/N > 999 mΩ

E mΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E mΩ

LEAKAGE CURRENT

L+N/E mA

INSULATION RESISTANCE

L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

PROTECTION DEVICES

PLC

VSD

SOFTSTARTS

OTHER _____

COMMENTS Megger readings the same for all panels

SIGNED Adam Hand/M. Martin WITNESS _____ DRAWING NO _____

RELEASED Sept 1st 1998 RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4828

PROJECT TITLE 5-7 Carlton Garden's JOB NO. 558 TEST DATE 1/10/98.

PANEL TITLE D.B. 1/T1

CLIENT T CLARKE PLC. INSPECTION / TEST AT WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING n/a IP RATING IP42 SHORT CIRCUIT RATING / VOLTAGE 460v

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK n/a BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO ca 94

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST 1000V MEGGER TEST 2 10A DUCTOR TEST

SERIAL NO 9609331092 SERIAL NO _____ SERIAL NO _____ SERIAL NO _____

INSULATION RESISTANCE	LEAKAGE CURRENT	INSULATION RESISTANCE	BUSBAR RESISTANCE
R/S <u>>999</u> MΩ	R/S <input type="checkbox"/> mA	R/S <input type="checkbox"/> MΩ	R <input type="checkbox"/> mΩ
S/T <u>>999</u> MΩ	S/T <input type="checkbox"/> mA	S/T <input type="checkbox"/> MΩ	S <input type="checkbox"/> mΩ
T/R <u>>999</u> MΩ	T/R <input type="checkbox"/> mA	T/R <input type="checkbox"/> MΩ	T <input type="checkbox"/> mΩ
R/N <u>>999</u> MΩ	R/N <input type="checkbox"/> mA	R/N <input type="checkbox"/> MΩ	N <input type="checkbox"/> mΩ
S/N <u>>999</u> MΩ	S/N <input type="checkbox"/> mA	S/N <input type="checkbox"/> MΩ	E <input type="checkbox"/> mΩ
T/N <u>>999</u> MΩ	T/N <input type="checkbox"/> mA	T/N <input type="checkbox"/> MΩ	
R/E <u>>999</u> MΩ	R/E <input type="checkbox"/> mA	R/E <input type="checkbox"/> MΩ	
S/E <u>>999</u> MΩ	S/E <input type="checkbox"/> mA	S/E <input type="checkbox"/> MΩ	
T/E <u>>999</u> MΩ	T/E <input type="checkbox"/> mA	T/E <input type="checkbox"/> MΩ	
NE <u>>999</u> MΩ	N/E <input type="checkbox"/> mA	N/E <input type="checkbox"/> MΩ	

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE
L+N/E MΩ L+N/E mA L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION n/a POWER CIRCUIT CONTINUITY INSTRUMENTATION n/a

PROTECTION DEVICES PLC n/a VSO n/a SOFTSTARTS n/a

OTHER _____

COMMENTS _____

STATE as tested. WITNESS _____ DRAWING NO 558/2.1

RELEASED Stephen Murphy RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4824

PROJECT TITLE E-7 Carlton Gardens JOB NO. 558 TEST DATE 30/9/98

PANEL TITLE Landlord 3/EL1 + 3/L1

CLIENT T. Clarke PLC INSPECTION / TEST AT
WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING n/a IP RATING IP42 SHORT CIRCUIT RATING VOLTAGE 240V

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK n/a BUSBAR SCREENS n/a COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0099

ELCTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

SERIAL NO 96G9331092 SERIAL NO _____

INSULATION RESISTANCE

R/S	<u>>999</u>	MΩ	R/S	<u> </u>	mA
S/T	<u>>999</u>	MΩ	S/T	<u> </u>	mA
T/R	<u>>999</u>	MΩ	T/R	<u> </u>	mA
R/N	<u>>999</u>	MΩ	R/N	<u> </u>	mA
S/N	<u>>999</u>	MΩ	S/N	<u> </u>	mA
T/N	<u>>999</u>	MΩ	T/N	<u> </u>	mA
R/E	<u>>999</u>	MΩ	R/E	<u> </u>	mA
S/E	<u>>999</u>	MΩ	S/E	<u> </u>	mA
T/E	<u>>999</u>	MΩ	T/E	<u> </u>	mA
E	<u>>999</u>	MΩ	N/E	<u> </u>	mA

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E MΩ L+N/E mA

FUNCTION TEST

CONTROL CIRCUIT OPERATION POWER CIRCUIT CONTINUITY INSTRUMENTATION n/a

PROTECTION DEVICES PLC n/a VSD n/a SOFTSTARTS n/a

OTHER _____

COMMENTS _____

TESTED B. Fuller WITNESS _____ DRAWING NO _____

RELEASED Steve Wynn RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4823

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558/C2 TEST DATE 30/9/98

PANEL TITLE L/LORD B/L2 + B/E2

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

 WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING N/A VOLTAGE 400

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO. 0099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO 960931092

SERIAL NO _____

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S	<u>>999</u> MΩ	R/S	<input type="checkbox"/> mA	R/S	<input type="checkbox"/> MΩ	R	<input type="checkbox"/> mΩ
S/T	<u>>999</u> MΩ	S/T	<input type="checkbox"/> mA	S/T	<input type="checkbox"/> MΩ	S	<input type="checkbox"/> mΩ
T/R	<u>>999</u> MΩ	T/R	<input type="checkbox"/> mA	T/R	<input type="checkbox"/> MΩ	T	<input type="checkbox"/> mΩ
R/N	<u>>999</u> MΩ	R/N	<input type="checkbox"/> mA	R/N	<input type="checkbox"/> MΩ	N	<input type="checkbox"/> mΩ
S/N	<u>>999</u> MΩ	S/N	<input type="checkbox"/> mA	S/N	<input type="checkbox"/> MΩ	E	<input type="checkbox"/> mΩ
T/N	<u>>999</u> MΩ	T/N	<input type="checkbox"/> mA	T/N	<input type="checkbox"/> MΩ		
R/E	<u>>999</u> MΩ	R/E	<input type="checkbox"/> mA	R/E	<input type="checkbox"/> MΩ		
S/E	<u>>999</u> MΩ	S/E	<input type="checkbox"/> mA	S/E	<input type="checkbox"/> MΩ		
T/E	<u>>999</u> MΩ	T/E	<input type="checkbox"/> mA	T/E	<input type="checkbox"/> MΩ		
N/E	<u>>999</u> MΩ	N/E	<input type="checkbox"/> mA	N/E	<input type="checkbox"/> MΩ		

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

PROTECTION DEVICES

PLC N/A

VSD N/A

SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED h/gf WITNESS _____ DRAWING NO _____

RELEASED Stephen Murphy RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4822

PROJECT TITLE S-7 CAXTON GARDENS. JOB NO. 558 TEST DATE 30/9/98

PANEL TITLE HANDOVER 6/EL1 + 6/L1

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

 WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING n/a IP RATING IP42 SHORT CIRCUIT RATING / VOLTAGE 400V

SAFETY SCREENING / PAINT WORK / DOOR LOCKS / LABELS /

SW/DOOR INTERLOCK n/a BUSBAR SCREENS n/a COMPONENT RATINGS /

CONNECTIONS TORQUED / TORQUE WRENCH SERIAL NO 0099

ELCTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

SERIAL NO 7609331092

SERIAL NO _____

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

R/S	<u>>999</u> MΩ	R/S	<u>/</u> mA	INSULATION RESISTANCE	<u>/</u> MΩ	BUSBAR RESISTANCE	<u>/</u> mΩ
S/T	<u>>999</u> MΩ	S/T	<u>/</u> mA	S/T	<u>/</u> MΩ	S	<u>/</u> mΩ
T/R	<u>>999</u> MΩ	T/R	<u>/</u> mA	T/R	<u>/</u> MΩ	T	<u>/</u> mΩ
R/N	<u>>999</u> MΩ	R/N	<u>/</u> mA	R/N	<u>/</u> MΩ	N	<u>/</u> mΩ
S/N	<u>>999</u> MΩ	S/N	<u>/</u> mA	S/N	<u>/</u> MΩ	E	<u>/</u> mΩ
T/N	<u>>999</u> MΩ	T/N	<u>/</u> mA	T/N	<u>/</u> MΩ		
R/E	<u>>999</u> MΩ	R/E	<u>/</u> mA	R/E	<u>/</u> MΩ		
S/E	<u>>999</u> MΩ	S/E	<u>/</u> mA	S/E	<u>/</u> MΩ		
T/E	<u>>999</u> MΩ	T/E	<u>/</u> mA	T/E	<u>/</u> MΩ		
E	<u>>999</u> MΩ	N/E	<u>/</u> mA	N/E	<u>/</u> MΩ		

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

L+N/E / MΩ L+N/E / mA L+N/E / MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION /

POWER CIRCUIT CONTINUITY /

INSTRUMENTATION n/a

PROTECTION DEVICES /

PLC n/a

VSD n/a

SOFTSTARTS n/a

n/a

OTHER _____

COMMENTS _____

TESTED

A. Miller

WITNESS

DRAWING NO

558/1

RELEASED

Stephen Murphy

RELEASE DATE 3/10/98

INSPECTION / TEST CERTIFICATE 4829 ANDOR

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558/P1 TEST DATE 1/10/98

PANEL TITLE DB G/T1

CLIENT T. CLARKE PLC INSPECTION / TEST AT
WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANDOR ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING N/A VOLTAGE 400

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0029

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST 1000V MEGGER TEST 2 10A DUCTOR TEST

SERIAL NO 9609331092 SERIAL NO _____ SERIAL NO _____

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE BUSBAR RESISTANCE

R/S >999 MΩ R/S mA R/S MΩ R mΩ

S/T >999 MΩ S/T mA S/T MΩ S mΩ

T/R >999 MΩ T/R mA T/R MΩ T mΩ

R/N >999 MΩ R/N mA R/N MΩ N mΩ

S/N >999 MΩ S/N mA S/N MΩ E mΩ

T/N >999 MΩ T/N mA T/N MΩ

R/E >999 MΩ R/E mA R/E MΩ

S/E >999 MΩ S/E mA S/E MΩ

T/E >999 MΩ T/E mA T/E MΩ

E >999 MΩ N/E mA N/E MΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE

L+N/E MΩ L+N/E mA L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED F. Gough WITNESS _____ DRAWING NO 558/P1

RELEASED Steve Wynn RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4830

PROJECT TITLE S-7 CARLTON GARDENS, JOB NO. 558 TEST DATE 1/10/98
PANEL TITLE Landload 8/EL1 & 2/L1

CLIENT T. CLARKE PLC INSPECTION / TEST AT WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING n/a IP RATING IP42 SHORT CIRCUIT RATING VOLTAGE 240v

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK n/a BUSBAR SCREENS n/a COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO CC99

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 960933092 SERIAL NO _____

INSULATION RESISTANCE

R/S	<u>>999</u> MΩ	R/S	<u>mA</u>
S/T	<u>>999</u> MΩ	S/T	<u>mA</u>
T/R	<u>>999</u> MΩ	T/R	<u>mA</u>
R/N	<u>>999</u> MΩ	R/N	<u>mA</u>
S/N	<u>>999</u> MΩ	S/N	<u>mA</u>
T/N	<u>>999</u> MΩ	T/N	<u>mA</u>
R/E	<u>>999</u> MΩ	R/E	<u>mA</u>
S/E	<u>>999</u> MΩ	S/E	<u>mA</u>
T/E	<u>>999</u> MΩ	T/E	<u>mA</u>
N/E	<u>>999</u> MΩ	N/E	<u>mA</u>

1000V MEGGER TEST 2

SERIAL NO _____

INSULATION RESISTANCE

R/S	<u>mA</u>
S/T	<u>mA</u>
T/R	<u>mA</u>
R/N	<u>mA</u>
S/N	<u>mA</u>
T/N	<u>mA</u>
R/E	<u>mA</u>
S/E	<u>mA</u>
T/E	<u>mA</u>
N/E	<u>mA</u>

10A DUCTOR TEST

SERIAL NO _____

BUSBAR RESISTANCE

R	<u>mA</u>
S	<u>mA</u>
T	<u>mA</u>
N	<u>mA</u>
E	<u>mA</u>

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE

L+N/E MΩ L+N/E mA L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION POWER CIRCUIT CONTINUITY INSTRUMENTATION n/a

PROTECTION DEVICES PLC n/a VSD n/a SOFTSTARTS n/a

OTHER _____

COMMENTS _____

STED Bob Miller WITNESS _____ DRAWING NO 558/G

RELEASED Stefan Whyley RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4862 ANDOR

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 1-10-98

PANEL TITLE DB 2/T2

CLIENT T CLARKE PLC

INSPECTION / TEST AT



TESTS ARE CARRIED OUT AS DETAILED IN ANDOR ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING H2 SHORT CIRCUIT RATING 16KA VOLTAGE 415

SAFETY SCREENING PAINT. WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0297/10031

ELECTRICAL TEST

TER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 94120017411294 SERIAL NO 368061001696

1000V MEGGER TEST 2

SERIAL NO 94120017411294, SERIAL NO _____

10A DOCTOR TEST

INSULATION RESISTANCE		LEAKAGE CURRENT	
R/S	<u>1999</u> MΩ	R/S	<u>0-1</u> mA
S/T	<u>1999</u> MΩ	S/T	<u>0-1</u> mA
T/R	<u>1999</u> MΩ	T/R	<u>0-1</u> mA
R/N	<u>1999</u> MΩ	R/N	<u>0-1</u> mA
S/N	<u>1999</u> MΩ	S/N	<u>0-1</u> mA
T/N	<u>1999</u> MΩ	T/N	<u>0-1</u> mA
R/E	<u>1999</u> MΩ	R/E	<u>0-1</u> mA
S/E	<u>1999</u> MΩ	S/E	<u>0-1</u> mA
T/E	<u>1999</u> MΩ	T/E	<u>0-1</u> mA
N/E	<u>1999</u> MΩ	N/E	<u>0-1</u> mA

INSULATION RESISTANCE	
R/S	<u>1999</u> MΩ

BUSBAR RESISTANCE	
R	<input type="checkbox"/> mΩ
S	<input type="checkbox"/> mΩ
T	<input type="checkbox"/> mΩ
N	<input type="checkbox"/> mΩ
E	<input type="checkbox"/> mΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE		LEAKAGE CURRENT	
L+N/E	<input checked="" type="checkbox"/> MΩ	L+N/E	<input type="checkbox"/> mA

INSULATION RESISTANCE	
L+N/E	<input checked="" type="checkbox"/> MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED Johanne Darby WITNESS _____ DRAWING NO 558/02/2

RELEASED Stephen Murphy RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4863

PROJECT TITLE 5-7 CARLTON GARDEN'S JOB NO. 558 TEST DATE 1-10-98

PANEL TITLE DB 3/T2

CLIENT T CLARKE PLC INSPECTION / TEST AT WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 200A IP RATING 42 SHORT CIRCUIT RATING 16KA VOLTAGE 415

SAFETY SCREENING PAINT. WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0297/10031

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST

SERIAL NO 94120017411294 SERIAL NO 368061001696

1000V MEGGER TEST 2

SERIAL NO 94120017411294 SERIAL NO _____

10A DUCTOR TEST

INSULATION RESISTANCE

R/S	<u>2999</u> MΩ	LEAKAGE CURRENT	R/S	<u>0.1</u> mA
S/T	<u>2999</u> MΩ	S/T	<u>0.1</u> mA	
T/R	<u>2999</u> MΩ	T/R	<u>0.1</u> mA	
R/N	<u>2999</u> MΩ	R/N	<u>0.1</u> mA	
S/N	<u>2999</u> MΩ	S/N	<u>0.1</u> mA	
T/N	<u>2999</u> MΩ	T/N	<u>0.1</u> mA	
R/E	<u>2999</u> MΩ	R/E	<u>0.1</u> mA	
S/E	<u>2999</u> MΩ	S/E	<u>0.1</u> mA	
T/E	<u>2999</u> MΩ	T/E	<u>0.1</u> mA	
N/E	<u>2999</u> MΩ	N/E	<u>0.1</u> mA	

INSULATION RESISTANCE

R/S	<u>2999</u> MΩ	LEAKAGE CURRENT	R/S	<u>0.1</u> mA
S/T	<u>2999</u> MΩ	S/T	<u>0.1</u> mA	
T/R	<u>2999</u> MΩ	T/R	<u>0.1</u> mA	
R/N	<u>2999</u> MΩ	R/N	<u>0.1</u> mA	
S/N	<u>2999</u> MΩ	S/N	<u>0.1</u> mA	
T/N	<u>2999</u> MΩ	T/N	<u>0.1</u> mA	
R/E	<u>2999</u> MΩ	R/E	<u>0.1</u> mA	
S/E	<u>2999</u> MΩ	S/E	<u>0.1</u> mA	
T/E	<u>2999</u> MΩ	T/E	<u>0.1</u> mA	
N/E	<u>2999</u> MΩ	N/E	<u>0.1</u> mA	

BUSBAR RESISTANCE

R	<input type="checkbox"/>	mΩ
S	<input type="checkbox"/>	mΩ
T	<input type="checkbox"/>	mΩ
N	<input type="checkbox"/>	mΩ
E	<input type="checkbox"/>	mΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E MΩ

LEAKAGE CURRENT

L+N/E mA

INSULATION RESISTANCE

L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED Graham Parry WITNESS _____ DRAWING NO 558/52/1
RELEASED Steve Wray RELEASE DATE 6/10/98

INSPECTION / TEST CERTIFICATE 4819

PROJECT TITLE S-7 CARLTON GARDENS JOB NO. 558 TEST DATE 30/9/98

PANEL TITLE DB G/T2

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
WORKS	SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING N/A VOLTAGE 400

SAFETY SCREENING PAINT, WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

SERIAL NO 9609331092

SERIAL NO _____

1000V MEGGER TEST 2

SERIAL NO _____

10A DUCTOR TEST

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

R/S	<u>>999</u>	MΩ	R/S	<input type="checkbox"/>	mA
S/T	<u>>999</u>	MΩ	S/T	<input type="checkbox"/>	mA
T/R	<u>>999</u>	MΩ	T/R	<input type="checkbox"/>	mA
R/N	<u>>999</u>	MΩ	R/N	<input type="checkbox"/>	mA
S/N	<u>>999</u>	MΩ	S/N	<input type="checkbox"/>	mA
T/N	<u>>999</u>	MΩ	T/N	<input type="checkbox"/>	mA
R/E	<u>>999</u>	MΩ	R/E	<input type="checkbox"/>	mA
S/E	<u>>999</u>	MΩ	S/E	<input type="checkbox"/>	mA
T/E	<u>>999</u>	MΩ	T/E	<input type="checkbox"/>	mA
E	<u>>999</u>	MΩ	N/E	<input type="checkbox"/>	mA

INSULATION RESISTANCE

R/S	<input type="checkbox"/>	MΩ
S/T	<input type="checkbox"/>	MΩ
T/R	<input type="checkbox"/>	MΩ
R/N	<input type="checkbox"/>	MΩ
S/N	<input type="checkbox"/>	MΩ
T/N	<input type="checkbox"/>	MΩ
R/E	<input type="checkbox"/>	MΩ
S/E	<input type="checkbox"/>	MΩ
T/E	<input type="checkbox"/>	MΩ
N/E	<input type="checkbox"/>	MΩ

BUSBAR RESISTANCE

R	<input type="checkbox"/>	mΩ
S	<input type="checkbox"/>	mΩ
T	<input type="checkbox"/>	mΩ
N	<input type="checkbox"/>	mΩ
E	<input type="checkbox"/>	mΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR.

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E MΩ

LEAKAGE CURRENT

L+N/E mA

INSULATION RESISTANCE

L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

N/A

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

N/A

PROTECTION DEVICES

PLC

N/A

VSD

N/A

SOFTSTARTS

N/A

OTHER _____

COMMENTS _____

TESTED F. Gough

WITNESS _____

DRAWING NO. SS 8/192

RELEASED Steve Whish

RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4831

PROJECT TITLE S-7 Carlton Gardens JOB NO. 558/F TEST DATE 1/10/98

PANEL TITLE L/LORD 1/ELI + 1/LI

CLIENT T. CLARKE PLC INSPECTION / TEST AT

WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING N/A VOLTAGE 400

SAFETY SCREENING PAINT. WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A GUCTOR TEST

SERIAL NO 960933/092

SERIAL NO _____

SERIAL NO _____

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S	<u>>999</u> mΩ	R/S	<u> </u> mA	R/S	<u> </u> mΩ	R	<u> </u> mΩ
S/T	<u>>999</u> mΩ	S/T	<u> </u> mA	S/T	<u> </u> mΩ	S	<u> </u> mΩ
T/R	<u>>999</u> mΩ	T/R	<u> </u> mA	T/R	<u> </u> mΩ	T	<u> </u> mΩ
R/N	<u>>999</u> mΩ	R/N	<u> </u> mA	R/N	<u> </u> mΩ	N	<u> </u> mΩ
S/N	<u>>999</u> mΩ	S/N	<u> </u> mA	S/N	<u> </u> mΩ	E	<u> </u> mΩ
T/N	<u>>999</u> mΩ	T/N	<u> </u> mA	T/N	<u> </u> mΩ	NOTE: RESISTANCE MEASURED	
R/E	<u>>999</u> mΩ	R/E	<u> </u> mA	R/E	<u> </u> mΩ	ACROSS EXTREME ENDS OF	
S/E	<u>>999</u> mΩ	S/E	<u> </u> mA	S/E	<u> </u> mΩ	EACH BUSBAR	
T/E	<u>>999</u> mΩ	T/E	<u> </u> mA	T/E	<u> </u> mΩ		
	<u>>999</u> mΩ	N/E	<u> </u> mA	N/E	<u> </u> mΩ		

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

L+N/E mΩ

L+N/E mA

L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

PROTECTION DEVICES

PLC N/A

VSD

N/A

SOFTSTARTS

N/A

OTHER _____

COMMENTS _____

TESTED F. Gough WITNESS _____ DRAWING NO 558/F

RELEASED Stephen Whyley RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4820

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 30/9/98

PANEL TITLE DB 2/TI

CLIENT T. CLARKE PLC INSPECTION / TEST AT

WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING N/A VOLTAGE 400

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 00099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

SERIAL NO 9609331092

2.5KV FLASHTEST

SERIAL NO _____

1000V MEGGER TEST 2

SERIAL NO _____

10A DUCTOR TEST

SERIAL NO _____

INSULATION RESISTANCE

	LEAKAGE CURRENT
R/S	>999 mΩ
S/T	>999 mΩ
T/R	>999 mΩ
R/N	>999 mΩ
S/N	>999 mΩ
T/N	>999 mΩ
R/E	>999 mΩ
S/E	>999 mΩ
T/E	>999 mΩ
E	>999 mΩ

INSULATION RESISTANCE

	mA
R/S	
S/T	
T/R	
R/N	
S/N	
T/N	
R/E	
S/E	
T/E	
N/E	

BUSBAR RESISTANCE

R	mΩ
S	
T	
N	
E	

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING

ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E mΩ

LEAKAGE CURRENT

L+N/E mA

INSULATION RESISTANCE

L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED F. Greigh WITNESS _____ DRAWING NO _____

RELEASED Steph Murphy RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4826

PROJECT TITLE E-7 CARLTON GARDENS JOB NO. 558 TEST DATE 1/10/98

PANEL TITLE Landlord LG/L1 + LG/EL1

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
WORKS	SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING IP42 SHORT CIRCUIT RATING - VOLTAGE 400v

SAFETY SCREENING / PAINT WORK / DOOR LOCKS / LABELS /

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS /

CONNECTIONS TORQUED / TORQUE WRENCH SERIAL NO C094

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO 9609331092

SERIAL NO _____

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S	<u>>999</u>	mΩ	R/S	<u>/</u>	mΩ	R	<u>/</u>	mΩ
S/T	<u>>999</u>	mΩ	S/T	<u>/</u>	mA	S	<u>/</u>	mΩ
T/R	<u>>999</u>	mΩ	T/R	<u>/</u>	mA	T	<u>/</u>	mΩ
R/N	<u>>999</u>	mΩ	R/N	<u>/</u>	mA	N	<u>/</u>	mΩ
S/N	<u>>999</u>	mΩ	S/N	<u>/</u>	mA	E	<u>/</u>	mΩ
T/N	<u>>999</u>	mΩ	T/N	<u>/</u>	mA			
R/E	<u>>999</u>	mΩ	R/E	<u>/</u>	mA			
S/E	<u>>999</u>	mΩ	S/E	<u>/</u>	mA			
T/E	<u>>999</u>	mΩ	T/E	<u>/</u>	mA			
E	<u>>999</u>	mΩ	N/E	<u>/</u>	mA			

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

L+N/E	<u>/</u>	mΩ	L+N/E	<u>/</u>	mA	L+N/E	<u>/</u>	mΩ
-------	----------	----	-------	----------	----	-------	----------	----

FUNCTION TEST

CONTROL CIRCUIT OPERATION / POWER CIRCUIT CONTINUITY / INSTRUMENTATION N/A

PROTECTION DEVICES / PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED B. Hallen WITNESS _____ DRAWING NO 558/D

RELEASED Stephen Wray RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4825

PROJECT TITLE S-7 CARLTON GARDENS JOB NO. 558 TEST DATE 1/10/98

PANEL TITLE DB LG/TI

CLIENT T. CLARKE PLC INSPECTION / TEST AT
WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING -N/A VOLTAGE 400

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO. 0999

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST 1000V MEGGER TEST 2 10A DUCTOR TEST

SERIAL NO 9609331092 SERIAL NO _____ SERIAL NO _____ SERIAL NO _____

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE BUSBAR RESISTANCE

R/S >999 MΩ R/S mA R/S MΩ R mΩ

S/T >999 MΩ S/T mA S/T MΩ S mΩ

T/R >999 MΩ T/R mA T/R MΩ T mΩ

R/N >999 MΩ R/N mA R/N MΩ N mΩ

S/N >999 MΩ S/N mA S/N MΩ E mΩ

T/N >999 MΩ T/N mA T/N MΩ

R/E >999 MΩ R/E mA R/E MΩ

S/E >999 MΩ S/E mA S/E MΩ

T/E >999 MΩ T/E mA T/E MΩ

N/E >999 MΩ N/E mA N/E MΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE

L+N/E MΩ L+N/E mA L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED F. Gaynor WITNESS _____ DRAWING NO _____

RELEASED Stephen Murphy RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4827

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 1/10/98

PANEL TITLE OB 1/T2

CLIENT T. CLARKE PLC INSPECTION / TEST AT

WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 42 SHORT CIRCUIT RATING N/A VOLTAGE 400

SAFETY SCREENING PAINT, WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1 2.5KV FLASHTEST 1000V MEGGER TEST 2 10A DUCTOR TEST

SERIAL NO 9609331092 SERIAL NO _____ SERIAL NO _____ SERIAL NO _____

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE BUSBAR RESISTANCE

R/S >999 MΩ R/S mA R/S MΩ R mΩ

S/T >999 MΩ S/T mA S/T MΩ S mΩ

T/R >999 MΩ T/R mA T/R MΩ T mΩ

R/N >999 MΩ R/N mA R/N MΩ N mΩ

S/N >999 MΩ S/N mA S/N MΩ E mΩ

T/N >999 MΩ T/N mA T/N MΩ

R/E >999 MΩ R/E mA R/E MΩ

S/E >999 MΩ S/E mA S/E MΩ

T/E >999 MΩ T/E mA T/E MΩ

N/E >999 MΩ N/E mA N/E MΩ

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR.

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE LEAKAGE CURRENT INSULATION RESISTANCE

L+N/E MΩ L-N/E mA L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED F.Gayt WITNESS _____ DRAWING NO _____

RELEASED Stephen Whaley RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4832

PROJECT TITLE S-7 Carlton Garden, No. 558 TEST DATE 1/10/98
PANEL TITLE Loadbank F/L1 + B/E1

CLIENT _____ INSPECTION / TEST AT
WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING IP RATING W42 SHORT CIRCUIT RATING VOLTAGE 400v

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK BUSBAR SCREENS COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO EDD 99

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO _____

SERIAL NO _____

SERIAL NO _____

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S	<u>>999</u>	mΩ	R/S	<input checked="" type="checkbox"/>	mΩ	R	<input checked="" type="checkbox"/>	mΩ
S/T	<u>>999</u>	mΩ	S/T	<input checked="" type="checkbox"/>	mΩ	S	<input checked="" type="checkbox"/>	mΩ
T/R	<u>>999</u>	mΩ	T/R	<input checked="" type="checkbox"/>	mΩ	T	<input checked="" type="checkbox"/>	mΩ
R/N	<u>>999</u>	mΩ	R/N	<input checked="" type="checkbox"/>	mΩ	N	<input checked="" type="checkbox"/>	mΩ
S/N	<u>>999</u>	mΩ	S/N	<input checked="" type="checkbox"/>	mΩ	E	<input checked="" type="checkbox"/>	mΩ
T/N	<u>>999</u>	mΩ	T/N	<input checked="" type="checkbox"/>	mΩ			
R/E	<u>>999</u>	mΩ	R/E	<input checked="" type="checkbox"/>	mΩ			
S/E	<u>>999</u>	mΩ	S/E	<input checked="" type="checkbox"/>	mΩ			
T/E	<u>>999</u>	mΩ	T/E	<input checked="" type="checkbox"/>	mΩ			
N/E	<u>>999</u>	mΩ	N/E	<input checked="" type="checkbox"/>	mΩ			

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR.

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

L+N/E mΩ

L+N/E mA

L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

PROTECTION DEVICES

PLC

VSD

SOFTSTARTS

SPS

OTHER _____

COMMENTS _____

STED

Z. Mallon

WITNESS _____

DRAWING NO 558/C1

RELEASED Steph. May

RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4821

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 30/9/98

PANEL TITLE LANDLORD 4/EL1 & 4/L1

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
WORKS	SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING n/a IP RATING IP42 SHORT CIRCUIT RATING / VOLTAGE 400

SAFETY SCREENING / PAINT WORK / DOOR LOCKS / LABELS /

SW/DOOR INTERLOCK n/a BUSBAR SCREENS n/a COMPONENT RATINGS /

CONNECTIONS TORQUED / TORQUE WRENCH SERIAL NO 0099

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO 9609331092

SERIAL NO _____

SERIAL NO _____

INSULATION RESISTANCE

R/S >999 MΩ

LEAKAGE CURRENT

R/S / mA

INSULATION RESISTANCE

R/S / MΩ

BUSBAR RESISTANCE

R / mΩ

S/T >999 MΩ

S/T / mA

S/T / MΩ

S / mΩ

T/R >999 MΩ

T/R / mA

T/R / MΩ

T / mΩ

R/N >999 MΩ

R/N / mA

R/N / MΩ

N / mΩ

S/N >999 MΩ

S/N / mA

S/N / MΩ

E / mΩ

T/N >999 MΩ

T/N / mA

T/N / MΩ

NOTE: RESISTANCE MEASURED

R/E >999 MΩ

R/E / mA

R/E / MΩ

ACROSS EXTREME ENDS OF

S/E >999 MΩ

S/E / mA

S/E / MΩ

EACH BUSBAR

T/E >999 MΩ

T/E / mA

T/E / MΩ

E >999 MΩ

N/E / mA

N/E / MΩ

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

L+N/E / MΩ

LEAKAGE CURRENT

L+N/E / mA

INSULATION RESISTANCE

L+N/E / MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION /

POWER CIRCUIT CONTINUITY /

INSTRUMENTATION n/a

PROTECTION DEVICES /

PLC n/a

VSD n/a

SOFTSTARTS n/a

OTHER _____

COMMENTS _____

TESTED B. Hall

WITNESS _____ DRAWING NO. 558/J

RELEASED Stephen Murphy

RELEASE DATE 7/10/98

INSPECTION / TEST CERTIFICATE 4873

PROJECT TITLE CARLTON GARDENS JOB NO. 558 TEST DATE 19/10/98
PANEL TITLE DISTRIBUTION BOARD LG/T2
CLIENT T. CLARKE PLC. INSPECTION / TEST AT WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE QP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING N/A IP RATING 31 SHORT CIRCUIT RATING N/A VOLTAGE 415

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK N/A BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 0896/44726

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1	2.5KV FLASHTEST	1000V MEGGER TEST 2	10A DUCTOR TEST
SERIAL NO <u>9412001761</u>	SERIAL NO <u>368E610010696</u>	SERIAL NO <u>9612001741</u>	SERIAL NO _____

INSULATION RESISTANCE		LEAKAGE CURRENT		INSULATION RESISTANCE		BUSBAR RESISTANCE	
R/S	<u>>999</u> MΩ	R/S	<u>0.2</u> mA	R/S	<u>>999</u> MΩ	R	<u> </u> mΩ
S/T	<u>>999</u> MΩ	S/T	<u>0.2</u> mA	S/T	<u>>999</u> MΩ	S	<u> </u> mΩ
T/R	<u>>999</u> MΩ	T/R	<u>0.2</u> mA	T/R	<u>>999</u> MΩ	T	<u> </u> mΩ
R/N	<u>>999</u> MΩ	R/N	<u>0.2</u> mA	R/N	<u>>999</u> MΩ	N	<u> </u> mΩ
S/N	<u>>999</u> MΩ	S/N	<u>0.2</u> mA	S/N	<u>>999</u> MΩ	E	<u> </u> mΩ
T/N	<u>>999</u> MΩ	T/N	<u>0.2</u> mA	T/N	<u>>999</u> MΩ	NOTE: RESISTANCE MEASURED ACROSS EXTREME ENDS OF EACH BUSBAR	
R/E	<u>>999</u> MΩ	R/E	<u>0.1</u> mA	R/E	<u>>999</u> MΩ		
S/E	<u>>999</u> MΩ	S/E	<u>0.1</u> mA	S/E	<u>>999</u> MΩ		
T/E	<u>>999</u> MΩ	T/E	<u>0.1</u> mA	T/E	<u>>999</u> MΩ		
	<u>>999</u> MΩ	N/E	<u>0.1</u> mA	N/E	<u>>999</u> MΩ		

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE	LEAKAGE CURRENT	INSULATION RESISTANCE
L+N/E <input checked="" type="checkbox"/> MΩ	L+N/E <input checked="" type="checkbox"/> mA	L+N/E <input checked="" type="checkbox"/> MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION N/A POWER CIRCUIT CONTINUITY INSTRUMENTATION N/A

PROTECTION DEVICES PLC N/A VSD N/A SOFTSTARTS N/A

OTHER _____

COMMENTS _____

TESTED P. D. Smith WITNESS _____ DRAWING NO 558/12

RELEASED RELEASE DATE 17/10/98

INSPECTION / TEST CERTIFICATE 4771

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 TEST DATE 7/11/98

PANEL TITLE SB 02

CLIENT T. CLARKE PLC

INSPECTION / TEST AT

<input checked="" type="checkbox"/>	<input type="checkbox"/>
WORKS	SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 2000A IP RATING IP31 SHORT CIRCUIT RATING 50kA/1SEC VOLTAGE 400V

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORQUE WRENCH SERIAL NO 1998 03583

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

1000V MEGGER TEST 2

10A DUCTOR TEST

SERIAL NO 9609331092

SERIAL NO 1004m586140

SERIAL NO 9609331092

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S	<u>>999</u>	MΩ	R/S	<u>.6 1.2</u>	mA	R/S	<u>>999</u>	MΩ	R	<input checked="" type="checkbox"/>	mΩ
S/T	<u>>999</u>	MΩ	S/T	<u>.7 1.2</u>	mA	S/T	<u>>999</u>	MΩ	S	<input checked="" type="checkbox"/>	mΩ
T/R	<u>>999</u>	MΩ	T/R	<u>.7 1.1</u>	mA	T/R	<u>>999</u>	MΩ	T	<input checked="" type="checkbox"/>	mΩ
R/N	<u>>999</u>	MΩ	R/N	<u>.6 1.1</u>	mA	R/N	<u>>999</u>	MΩ	N	<input checked="" type="checkbox"/>	mΩ
S/N	<u>>999</u>	MΩ	S/N	<u>.5 1</u>	mA	S/N	<u>>999</u>	MΩ	E	<input checked="" type="checkbox"/>	mΩ
T/N	<u>>999</u>	MΩ	T/N	<u>.6 1</u>	mA	T/N	<u>>999</u>	MΩ			
R/E	<u>>999</u>	MΩ	R/E	<u>.9 1.4</u>	mA	R/E	<u>>999</u>	MΩ			
S/E	<u>>999</u>	MΩ	S/E	<u>.8 1.1</u>	mA	S/E	<u>>999</u>	MΩ			
T/E	<u>>999</u>	MΩ	T/E	<u>.9 1.2</u>	mA	T/E	<u>>999</u>	MΩ			
E	<u>>999</u>	MΩ	N/E	<u>.8 1.1</u>	mA	N/E	<u>>999</u>	MΩ			

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORTED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

L+N/E MΩ

L+N/E mA

L+N/E MΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

PROTECTION DEVICES

PLC

VSD

SOFTSTARTS

OTHER

COMMENTS 17/11/98

John Bellantua
17/11/98

WITNESS

RELEASED John Bellantua

RELEASE DATE 18/11/98

DRAWING NO _____

INSPECTION / TEST CERTIFICATE 4775

PROJECT TITLE 5-7 CARLTON GARDENS JOB NO. 558 A TEST DATE 9/11/98

PANEL TITLE SB01

CLIENT T. CLARKE PLC INSPECTION / TEST AT WORKS SITE

TESTS ARE CARRIED OUT AS DETAILED IN ANORD ELECTRIC CONTROLS LTD SWITCHBOARD INSPECTION AND TEST PROCEDURE OP27 AND/OR AS DETAILED IN THE PARTICULAR PROJECT TEST PROCEDURE NO _____ AND UNIT TEST RECORD _____

MECHANICAL INSPECTION

BUSBAR RATING 2000 A IP RATING IP31 SHORT CIRCUIT RATING 50ka/1sec VOLTAGE 400V

SAFETY SCREENING PAINT WORK DOOR LOCKS LABELS

SW/DOOR INTERLOCK BUSBAR SCREENS N/A COMPONENT RATINGS

CONNECTIONS TORQUED TORSQUE WRENCH SERIAL NO 1998 03583

ELECTRICAL TEST

POWER WIRING

1000V MEGGER TEST 1

2.5KV FLASHTEST

Code No. 17588

SERIAL NO 9609331092

SERIAL NO 1000V 588140

1000V MEGGER TEST 2

SERIAL NO 9609331092

10A DUCTOR TEST

SERIAL NO _____

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

BUSBAR RESISTANCE

R/S	<u>>999</u>	mΩ	R/S	<u>2.5</u>	mA	R/S	<u>>999</u>	mΩ	R	<input checked="" type="checkbox"/>	mΩ
S/T	<u>>999</u>	mΩ	S/T	<u>2.5</u>	mA	S/T	<u>>999</u>	mΩ	S	<input checked="" type="checkbox"/>	mΩ
T/R	<u>>999</u>	mΩ	T/R	<u>2.2</u>	mA	T/R	<u>>999</u>	mΩ	T	<input checked="" type="checkbox"/>	mΩ
R/N	<u>>999</u>	mΩ	R/N	<u>2.1</u>	mA	R/N	<u>>999</u>	mΩ	N	<input checked="" type="checkbox"/>	mΩ
S/N	<u>>999</u>	mΩ	S/N	<u>2.0</u>	mA	S/N	<u>>999</u>	mΩ	E	<input checked="" type="checkbox"/>	mΩ
T/N	<u>>999</u>	mΩ	T/N	<u>2.2</u>	mA	T/N	<u>>999</u>	mΩ			
R/E	<u>>999</u>	mΩ	R/E	<u>2.9</u>	mA	R/E	<u>>999</u>	mΩ			
S/E	<u>>999</u>	mΩ	S/E	<u>2.8</u>	mA	S/E	<u>>999</u>	mΩ			
T/E	<u>>999</u>	mΩ	T/E	<u>2.8</u>	mA	T/E	<u>>999</u>	mΩ			
	<u>>999</u>	mΩ	N/E	<u>2.7</u>	mA	N/E	<u>>999</u>	mΩ			

NOTE: RESISTANCE MEASURED
ACROSS EXTREME ENDS OF
EACH BUSBAR

CONTROL WIRING ALL CONTROL WIRING IS SHORDED TOGETHER FOR THIS TEST

INSULATION RESISTANCE

LEAKAGE CURRENT

INSULATION RESISTANCE

L+N/E mΩ

L+N/E mA

L+N/E mΩ

FUNCTION TEST

CONTROL CIRCUIT OPERATION

POWER CIRCUIT CONTINUITY

INSTRUMENTATION

PROTECTION DEVICES

PLC

VSD

SOFTSTARTS

OTHER _____

COMMENTS J. Hall 17-11-98

John Ballantyne CMG
17/11/98

TEC Martin Kelly

WITNESS John Ballantyne

DRAWING NO. _____

RELEASED John Ballantyne

RELEASE DATE 18/11/98

Anord: Job No. 558/4390
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
SPARES LIST

COMPONENT	TYPE	MANUFACTURER	QTY	UNIT PRICE
ACB	E2N 2000 4P WD NON AUTO	ABB	N/A	N/A
ACB	E2N 2000 4P WD PR112 LSIG	ABB	N/A	N/A
ACB AUX	ISDAO 38327 R1	ABB	N/A	N/A
ACB AUX	ISDAO 43467R1	ABB	N/A	N/A
ACB CHASSIS	E2 4P	ABB	N/A	N/A
AUX CON	ISDAO 43475 15 WAY	ABB	N/A	N/A
AUX CONT	ISDAO 13575 S3	ABB	N/A	N/A
AUXILLARY	CA7-01	ABB	N/A	N/A
CLOS COIL	ISDAO 38287R1	ABB	1	£48.49
CONTACTOR	A75-4-11 4P	ABB	1	£111.58
CONTACTOR	CA5-700	ABB	1	£47.46
CONTACTOR	EK145-4P	ABB	1	£254.28
CONTACTOR	UB30-30-10R	ABB	1	£62.45
COUNTER	ISDAO 38345 OP	ABB	1	£52.71
E MAX MOTOR	ISDAO 38324 R1	ABB	1	£275.91
GUARD	ISDAO 38343 R1 PB	ABB	1	£12.13
INTERLOCK	VB 75	ABB	1	£7.98
INTERLOCK	VH 145	ABB	1	£18.12
ISOLATOR	OETL 200K4	ABB	1	£83.40
ISOLATOR	OETL ZA86 500MM SHAFT	ABB	1	£10.50
ISOLATOR	OT 125E4	ABB	2	£37.85
MCCB	ISDAO 13857	ABB	2	£44.70
MCCB	ISDAO 13846R1 230V UVR	ABB	1	£33.25
MCCB	S3/4/5 AD R/H ISDAO13869 R1	ABB	1	£8.08
MCCB	S5H 400A 4P PR212 LSIG	ABB	N/A	N/A
MCCB	S5H 400A N/CT	ABB	1	£31.15
MCCB	S5H 600A 3P FXD PR211 PLI	ABB	1	£558.14
MECH INTERLOCK	VE 5/2	ABB	1	£9.88
MOTOR MECH	ISDAO 13876	ABB	1	£177.46
POS/LOCK	ISDAO 38357 R1	ABB	1	£23.18
HUT/LOCK	ISDAO 38363 R1	ABB	1	£19.98
TRIP CONTACT	ISDAO 38337R1	ABB	1	£17.29
TRIP CONTACT	ISDAO 38338R1	ABB	1	£17.29
TRANSFORMER	50VA	APEX	1	£25.60
AMBER LENS	RM600	BRETER	2	£0.28
BLACK PLATE	RT010	BRETER	2	£0.12
CLEAR LENS	RM600	BRETER	2	£0.30
CONTACT BLOCK	V40 N/C	BRETER	2	£1.00
GREEN LENS	RM600	BRETER	2	£0.26
KEY SWITCH	RM200N 2POS	BRETER	1	£6.37
LOCK STOP	RM065R	BRETER	1	£5.37
LOCK STOP	V50 N/O	BRETER	1	£4.92
MOMENTARY P/BUTTON	RT010	BRETER	1	£1.72
PILOT LIGHT	RM600	BRETER	1	£2.88
PILOT LIGHT	RM600	BRETER	1	£2.88
RED LENS	RM600	BRETER	2	£0.26
SEL SWITCH	RM410N 3POS	BRETER	1	£4.12
SPRING RETURN	RM450N 2POS	BRETER	1	£2.95
SPRING RETURN	RM480N 3POS	BRETER	1	£4.15

A'nd: Job No. 558/4390
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
SPARES LIST

SPRING RETURN	RM483	BRETER	1	£4.25
TRAFO	570 220/6V	BRETER	1	£5.31
YELLOW LENS	RM600	BRETER	1	£0.35
BACK STUD	32 BS	BUSSMANN	3	£1.00
BACK STUD	63/100 BS	BUSSMANN	3	£1.72
BLACK FUSE BASE	CM20F	BUSSMANN	3	£3.31
BLACK FUSE BASE	CM32F	BUSSMANN	3	£6.23
BS88 FUSE	NIT 10A NITD10	BUSSMANN	3	£0.51
BS88 FUSE	NIT 2A NITD2	BUSSMANN	3	£0.51
BS88 FUSE	NIT 4A NITD4	BUSSMANN	3	£0.49
BS88 FUSE	NIT 6A NITD6	BUSSMANN	3	£0.51
BS88 FUSE	TCP 100A CEO100	BUSSMANN	3	£2.31
BS88 FUSE	TCP 63A CEO63	BUSSMANN	3	£2.06
BS88 FUSE	TCP 80A CEO80	BUSSMANN	3	£2.31
BS88 FUSE	TF 160A DD160	BUSSMANN	3	£3.94
BS88 FUSE	TF 200A DD200	BUSSMANN	3	£0.43
BS88 FUSE	TIA 25A AAO25	BUSSMANN	3	£0.85
BS88 FUSE	TIA 32A AAO32	BUSSMANN	3	£0.86
BS88 FUSE	TIS 63A BAO63	BUSSMANN	3	£1.38
BS88 FUSE	TKF 250A ED250	BUSSMANN	3	£5.48
BS88 FUSE	TMF 400A ED400	BUSSMANN	3	£6.92
BUSBAR SUPPORT	01-495	BUSSMANN	3	£3.57
FUSE	TCP 32A CE032	BUSSMANN	3	£2.08
WHITE FUSE BASE	CM20FW	BUSSMANN	3	£3.91
WHITE FUSE BASE	CM32FW	BUSSMANN	3	£4.77
WHITE FUSE BASE	CM63F	BUSSMANN	3	£7.35
FUSE	6A 10X38 420006	DF	3	£0.15
FUSE	NHOO 100A 300100	DF	3	£1.29
FUSE	NHOO 63A 300063	DF	3	£1.29
FUSE BASE	10X38 450032	DF	1	£0.98
NEUTRAL	10X38 450032N	DF	1	£1.20
TIMER	BA 9043/002 3P4W C/W	DOLD	1	£86.26
CAPACITOR	MKP600V 12.5KVAR	ELECTRONICON	N/A	N/A
PF RELAY	CR2000 8STAGE PFC	ELECTRONICON	N/A	N/A
MFE TIMER	2.550.029.81	ENTRELEC	N/A	N/A
BLANKS	F/029000-072	GE	N/A	N/A
DIST BD + KEY	8 WAY TP	GE	N/A	N/A
ELCB	25A DP V/304-022030	GE	1	£18.58
ELCB	40A DP V/304-024030	GE	1	£18.58
EXT PLAIN/KEY	1 ROW 18MOD	GE	N/A	N/A
ISOLATOR	200A 3P + N CD/061526-201	GE	1	£55.62
ISOLATOR	200A 3P+N DILOS	GE	1	£51.34
MCB	1C10-6-6K V/0099-004110	GE	2	£3.03
MCB	1C16-6 6K V/0099-004116	GE	2	£3.03
MCB	1C20-6-6K V/0099-004120	GE	2	£3.03
MCB	1C2-6-6K V/099-004102	GE	2	£3.03
MCB	1C32-6-6K V/0099-004132	GE	2	£3.03
MCB	1C40-6-6K V/0099-004140	GE	2	£3.03
MCB	3C16-6-6K V/099-004316	GE	1	£9.82
MCB	3C20-10-10K V/0099-007320	GE	1	£16.77
MCB	3C20-6-6K V/0099-004320	GE	1	£9.82

Anord: Job No. 558/4390
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
SPARES LIST

MCB	3C32-10 10K V/0099-007332	GE	1	£21.92
MCB	3C40-6-6K V/0099-004340	GE	1	£9.82
POWER RELAY	MWTU 11 REVERSE	GEC	N/A	N/A
RELAY	MAVS 01	GEC	N/A	N/A
RELAY	MCAG 14 20-80%	GEC	N/A	N/A
RELAY	MCGG 22	GEC	N/A	N/A
RELAY	MVAA 13	GEC	N/A	N/A
RELAY	PRS11N02B	GEC	N/A	N/A
RELAY	SIZE 2 MVAA 13 CASE	GEC	N/A	N/A
RELAY	SIZE 4 MCGG 22 CASE	GEC	N/A	N/A
TEST BLOCK	MMLG	GEC	N/A	N/A
PROT COVER	1319.429	HOLEC	3	£16.54
PROT COVER	1319-423	HOLEC	3	£16.14
SWITCH FUSE	QSA100N1-A1/3N 1230.736	HOLEC	N/A	N/A
SWITCH FUSE	QSA100N1-A1/3N 1320.737	HOLEC	N/A	N/A
SWITCH FUSE	QSA200N1-B2/3NCTPR1320.808	HOLEC	N/A	N/A
SWITCH FUSE	QSA200N1-B2/3NCTPR1320.809	HOLEC	N/A	N/A
SWITCH FUSE	QSA400N-B4/3N CTPR1320.876	HOLEC	N/A	N/A
SWITCH FUSE	QSA400N-B4/3N CTPR1320.881	HOLEC	N/A	N/A
SWITCH FUSE	QSA400N-B4/3N CTRL1320.880	HOLEC	N/A	N/A
CT	100/5 TAI 200	IME	N/A	N/A
CT	2000/5 TAS 84	IME	N/A	N/A
MULTI FUNCTIONAL MET	NEMO LD/21	IME	N/A	N/A
CT	2000/5 10P20	INSTRUMENT TRANSFORMER	N/A	N/A
CT	800/5 CLASS X	INSTRUMENT TRANSFORMER	N/A	N/A
TIMER	KOL 311	OEM	N/A	N/A
VENT	SK 3326.200	RITTAL	N/A	N/A
CONTACTOR	100-C09-10	ROCKWELL	2	£10.43
CONTACTOR	100-C85-00	ROCKWELL	2	£95.43
RELAY	700HA32A03-3 8PIN 230V	ROCKWELL	2	£3.57
RELAY BASE	700HN100 8PIN	ROCKWELL	2	£1.55
RELAY	MRN2-24D G59	SEG	N/A	N/A
SURGE PROT DEV	WSP EMTP	WALSUR	N/A	N/A

Anord: Job No. 558/4390
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
PARTS LIST

COMPONENT	TYPE	MANUFACTURER	CODE
ACB	E2N 2000 4P WD NON AUTO	ABB	420226
ACB	E2N 2000 4P WD PR112 LSIG	ABB	420222
ACB AUX	ISDAO 38327 R1	ABB	420212
ACB AUX	ISDAO 43467R1	ABB	420293
ACB CHASSIS	E2 4P	ABB	480281
AUX CON	ISDAO 43475 15 WAY	ABB	420224
AUX CONT	ISDAO 13575 S3	ABB	420220
AUXILIARY	CA7-01	ABB	109926
CLOS COIL	ISDAO 38287R1	ABB	420223
CONTACTOR	A75-4-11 4P	ABB	106805
CONTACTOR	CA5-700	ABB	106807
CONTACTOR	EK145-4P	ABB	106806
CONTACTOR	UB30-30-10R	ABB	106507
COUNTER	ISDAO 38345 OP	ABB	306897
E MAX MOTOR	ISDAO 38324 R1	ABB	306858
GUARD	ISDAO 38343 R1 PB	ABB	420260
INTERLOCK	VB 75	ABB	109929
INTERLOCK	VH 145	ABB	180012
ISOLATOR	OETL 200K4	ABB	103174
ISOLATOR	OETL ZA86 500MM SHAFT	ABB	103008
ISOLATOR	OT 125E4	ABB	103165
MCCB	ISDAO 13857	ABB	420127
MCCB	ISDAO 13846R1 230V UVR	ABB	306496
MCCB	S3/4/5 AD R/H ISDAO13869 R1	ABB	420166
MCCB	S5H 400A 4P PR212 LSIG	ABB	420227
MCCB	S5H 400A N/CT	ABB	420058
MCCB	S5H 600A 3P FXD PR211 PLI	ABB	420221
MECH INTERLOCK	VE 5/2	ABB	180018
MOTOR MECH	ISDAO 13876	ABB	306302
POS/LOCK	ISDAO 38357 R1	ABB	420226
SET/LOCK	ISDAO 38363 R1	ABB	420229
TRIP CONTACT	ISDAO 38337R1	ABB	420292
TRIP CONTACT	ISDAO 38338R1	ABB	420291
TRANSFORMER	50VA	APEX	121057
AMBER LENS	RM600	BRETER	116077
BLACK PLATE	RT010	BRETER	116091
CLEAR LENS	RM600	BRETER	116079
CONTACT BLOCK	V40 N/C	BRETER	116010
GREEN LENS	RM600	BRETER	106075
KEY SWITCH	RM200N 2POS	BRETER	116201
LOCK STOP	RM065R	BRETER	116007
LOCK STOP	V50 N/O	BRETER	116007
MOMENTARY P/BUTTON	RT010	BRETER	116205
PILOT LIGHT	RM600	BRETER	116203
PILOT LIGHT	RM600	BRETER	116203
RED LENS	RM600	BRETER	116076
SEL SWITCH	RM410N 3POS	BRETER	116001
SPRING RETURN	RM450N 2POS	BRETER	116207
SPRING RETURN	RM480N 3POS	BRETER	116204

Anord: Job No. 558/4390
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
PARTS LIST

SPRING RETURN	RM483	BRETER	116213
TRAFO	570 220/6V	BRETER	116302
YELLOW LENS	RM600	BRETER	116094
BACK STUD	32 BS	BUSSMANN	604954
BACK STUD	63/100 BS	BUSSMANN	604955
BLACK FUSE BASE	CM20F	BUSSMANN	604950
BLACK FUSE BASE	CM32F	BUSSMANN	604951
BS88 FUSE	NIT 10A NITD10	BUSSMANN	607022
BS88 FUSE	NIT 2A NITD2	BUSSMANN	607016
BS88 FUSE	NIT 4A NITD4	BUSSMANN	607018
BS88 FUSE	NIT 6A NITD6	BUSSMANN	607020
BS88 FUSE	TCP 100A CEO100	BUSSMANN	607082
BS88 FUSE	TCP 63A CEO63	BUSSMANN	607096
BS88 FUSE	TCP 80A CEO80	BUSSMANN	607080
BS88 FUSE	TF 160A DD160	BUSSMANN	607142
BS88 FUSE	TF 200A DD200	BUSSMANN	607144
BS88 FUSE	TIA 25A AAO25	BUSSMANN	607044
BS88 FUSE	TIA 32A AAO32	BUSSMANN	607046
BS88 FUSE	TIS 63A BAO63	BUSSMANN	607054
BS88 FUSE	TKF 250A ED250	BUSSMANN	607146
BS88 FUSE	TMF 400A ED400	BUSSMANN	607152
BUSBAR SUPPORT	01-495	BUSSMANN	604960
FUSE	TCP 32A CE032	BUSSMANN	607090
WHITE FUSE BASE	CM20FW	BUSSMANN	604958
WHITE FUSE BASE	CM32FW	BUSSMANN	604964
WHITE FUSE BASE	CM63F	BUSSMANN	604956
FUSE	6A 10X38 420006	DF	604814
FUSE	NHOO 100A 300100	DF	604015
FUSE	NHOO 63A 300063	DF	604013
FUSE BASE	10X38 450032	DF	604810
NEUTRAL	10X38 450032N	DF	604811
TIMER	BA 9043/002 3P4W C/W	DOLD	141167
CAPACITOR	MKP600V 12.5KVAR	ELECTRONICON	121158
PF RELAY	CR2000 8STAGE PFC	ELECTRONICON	603781
MFE TIMER	2.550.029.81	ENTRELEC	603025
BLANKS	F/029000-072	GE	302977
DIST BD + KEY	8 WAY TP	GE	302980
ELCB	25A DP V/304-022030	GE	302966
ELCB	40A DP V/304-024030	GE	302985
EXT PLAIN/KEY	1 ROW 18MOD	GE	302975
ISOLATOR	200A 3P + N CD/061526-201	GE	302978
ISOLATOR	200A 3P+N DILOS	GE	302978
MCB	1C10-6-6K V/0099-004110	GE	302997
MCB	1C16-6 6K V/0099-004116	GE	302986
MCB	1C20-6-6K V/0099-004120	GE	302950
MCB	1C2-6-6K V/099-004102	GE	302912
MCB	1C32-6-6K V/0099-004132	GE	302987
MCB	1C40-6-6K V/0099-004140	GE	302988
MCB	3C16-6-6K V/099-004316	GE	302825
MCB	3C20-10-10K V/0099-007320	GE	302910
MCB	3C20-6-6K V/0099-004320	GE	302982

Anord: Job No. 558/4390
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
PARTS LIST

MCB	3C32-10 10K V/0099-007332	GE	302961
MCB	3C40-6-6K V/0099-004340	GE	302886
POWER RELAY	MWTU 11 REVERSE	GEC	408079
RELAY	MAVS 01	GEC	408008
RELAY	MCAG 14 20-80%	GEC	408096
RELAY	MCGG 22	GEC	408017
RELAY	MVAA 13	GEC	408052
RELAY	PRS11N02B	GEC	408136
RELAY	SIZE 2 MVAA 13 CASE	GEC	408123
RELAY	SIZE 4 MCGG 22 CASE	GEC	408124
TEST BLOCK	MMLG	GEC	408005
PROT COVER	1319.429	HOLEC	420433
PROT COVER	1319-423	HOLEC	420459
SWITCH FUSE	QSA100N1-A1/3N 1230.736	HOLEC	420456
SWITCH FUSE	QSA100N1-A1/3N 1320.737	HOLEC	420272
SWITCH FUSE	QSA200N1-B2/3N CTPR1320.808	HOLEC	420274
SWITCH FUSE	QSA200N1-B2/3N CTPR1320.809	HOLEC	420427
SWITCH FUSE	QSA400N-B4/3N CTPR1320.876	HOLEC	420456
SWITCH FUSE	QSA400N-B4/3N CTPR1320.881	HOLEC	420457
SWITCH FUSE	QSA400N-B4/3N CTRL1320.880	HOLEC	420461
CT	100/5 TAI 200	IME	149054
CT	2000/5 TAS 84	IME	148349
MULTI FUNCTIONAL METER	NEMO LD/21	IME	806016
CT	2000/5 10P20	INSTRUMENT TRANSFORMERS	139005
CT	800/5 CLASS X	INSTRUMENT TRANSFORMERS	139152
TIMER	KOL 311	OEM	603009
VENT	SK 3326.200	RITTAL	100189
CONTACTOR	100-C09-10	ROCKWELL	501201
CONTACTOR	100-C85-00	ROCKWELL	501223
RELAY	700HA32A03-3 8PIN 230V	ROCKWELL	501306
RELAY BASE	700HN100 8PIN	ROCKWELL	501307
RELAY	MRN2-24D G59	SEG	603783
SENSE PROT DEV	WSP EMTP	WALSUR	201302

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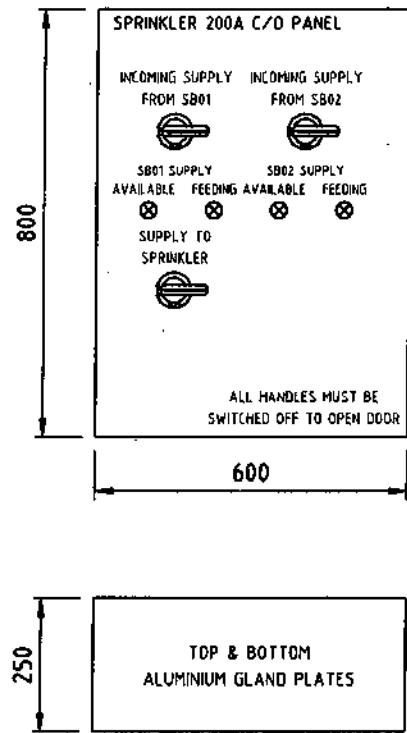
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ST6-825 ETA ENCLOSURE
IP 65 TOP ENTRY BOTTOM EXIT
WALL MOUNTED



CERTIFIED FINAL

DATE: 21.10.1998 A-7

Name	Date	
Drawn J. McEVoy	17-09-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

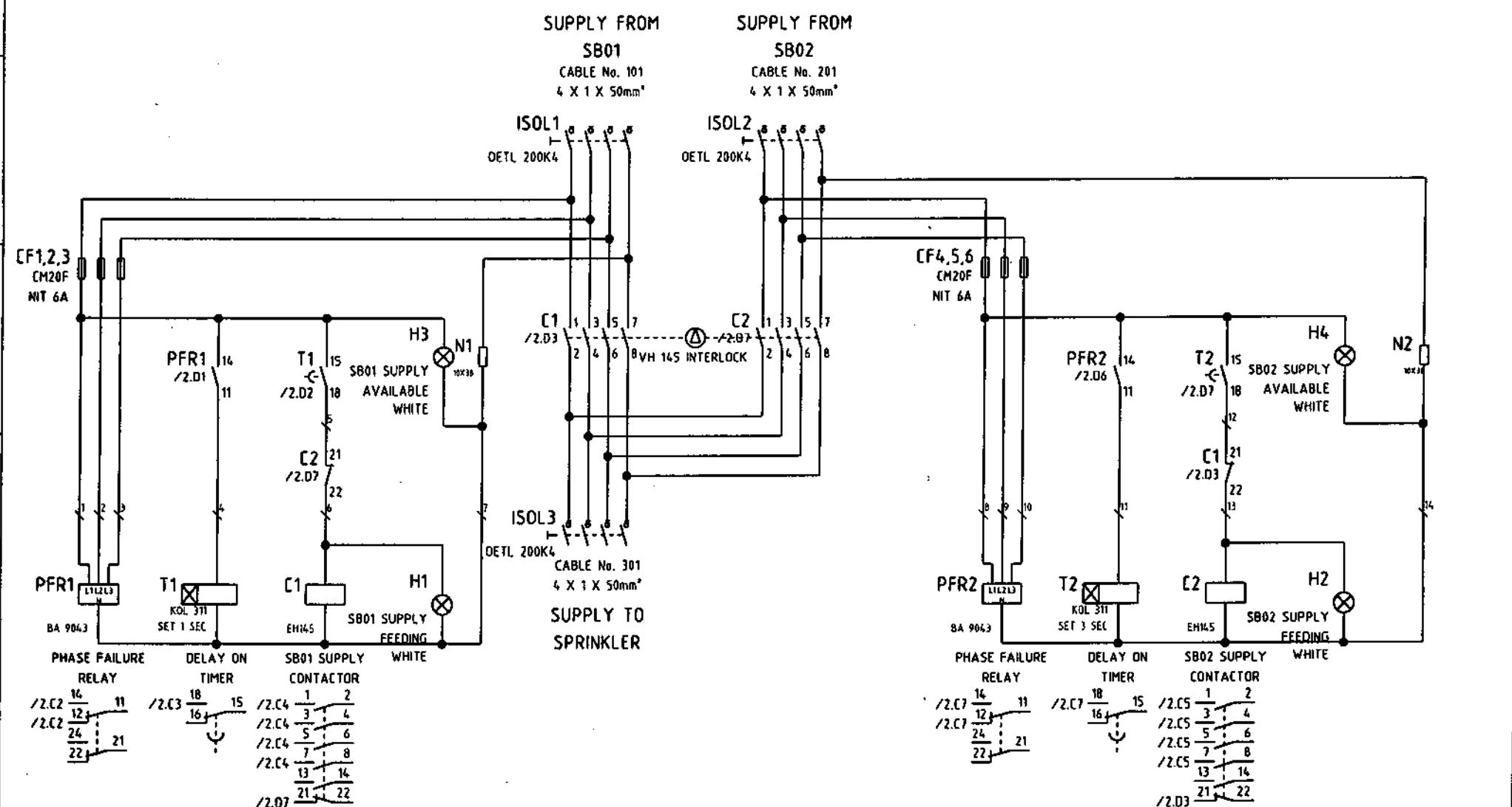
Title
SPRINKLER AUTO C/O (200A)
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
4390/A/1

Revision
1
of

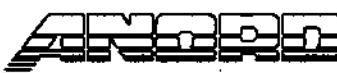
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CERTIFIED FINAL

DATE: 21.10.1998

A.T



Project
5-7 CARLTON GARDENS
LONDON

Title
SPRINKLER AUTO C/O (200A)
POWER SCHEMATIC

Client
T. CLARKE PLC

Consultant
OVE ARUP & PARTNERS

Drawing No.
4390/A/2

Revision
Sheet
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1
of

Name	Date
Drawn J. McEVoy	17-09-98
Chkd	
App'd	

1 2 3 4 5 6 7 8

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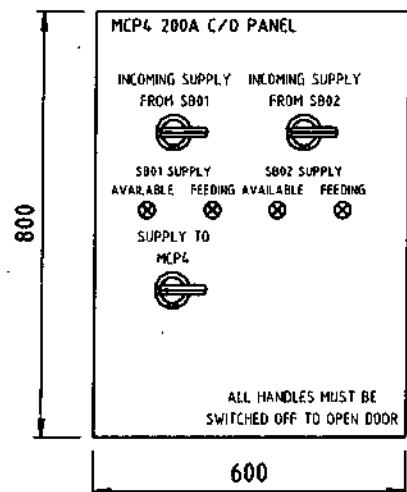
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ST6-825 ETA ENCLOSURE
IP 65 TOP ENTRY BOTTOM EXIT
WALL MOUNTED

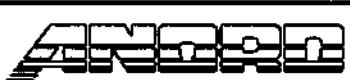


CERTIFIED FINAL

DATE: 21.10.1998

A.T

Drawn	Name	Date	
J. McEVoy		17-09-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

Title
MCP4 AUTO C/O (200A)
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
4390/B/1

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of

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1 2 3 4 5 6 7 8

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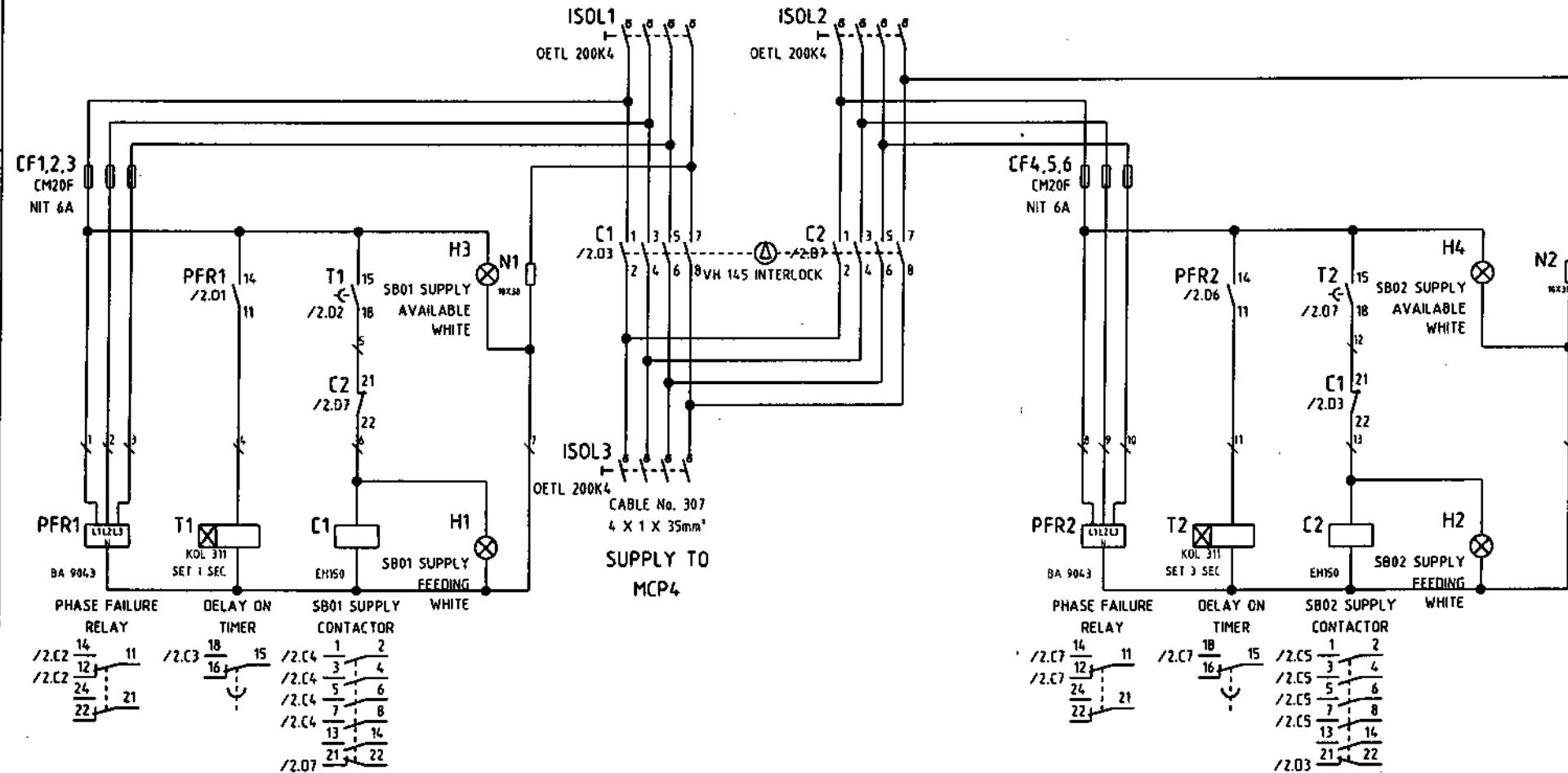
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SB01

CABLE No. 107
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SUPPLY FROM

SB02

CABLE No. 207
4 X 1 X 35mm²

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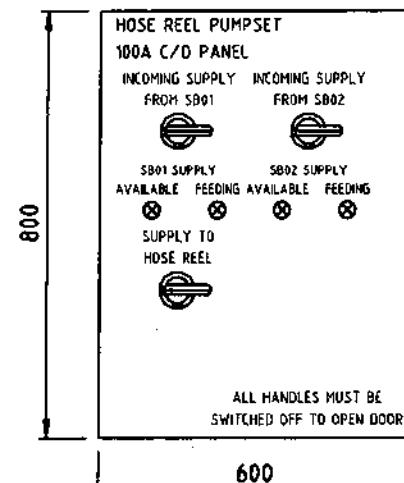
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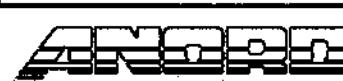
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ST6-825 ETA ENCLOSURE
IP 65 TOP ENTRY BOTTOM EXIT
WALL MOUNTED



CERTIFIED FINAL
DATE: 21.10.1998 *A.T.*

	Name	Date
Drawn	J. McEVoy	17-09-98
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

Title
HOSE REEL AUTO C/O [100A]
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
4390/C/1

Revision
Sheet
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1 2 3 4 5 6 7 8

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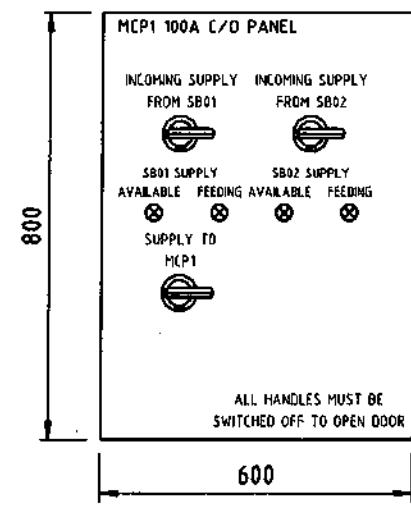
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ST6-825 ETA ENCLOSURE
IP 65 TOP ENTRY BOTTOM EXIT
WALL MOUNTED



CERTIFIED FINAL

DATE: 21.10.1998 A-T

	Name	Date	
Drawn	J. McEVY	17-09-98	
Chkd			
App'd			



Project
S-7 CARLTON GARDENS
LONDON

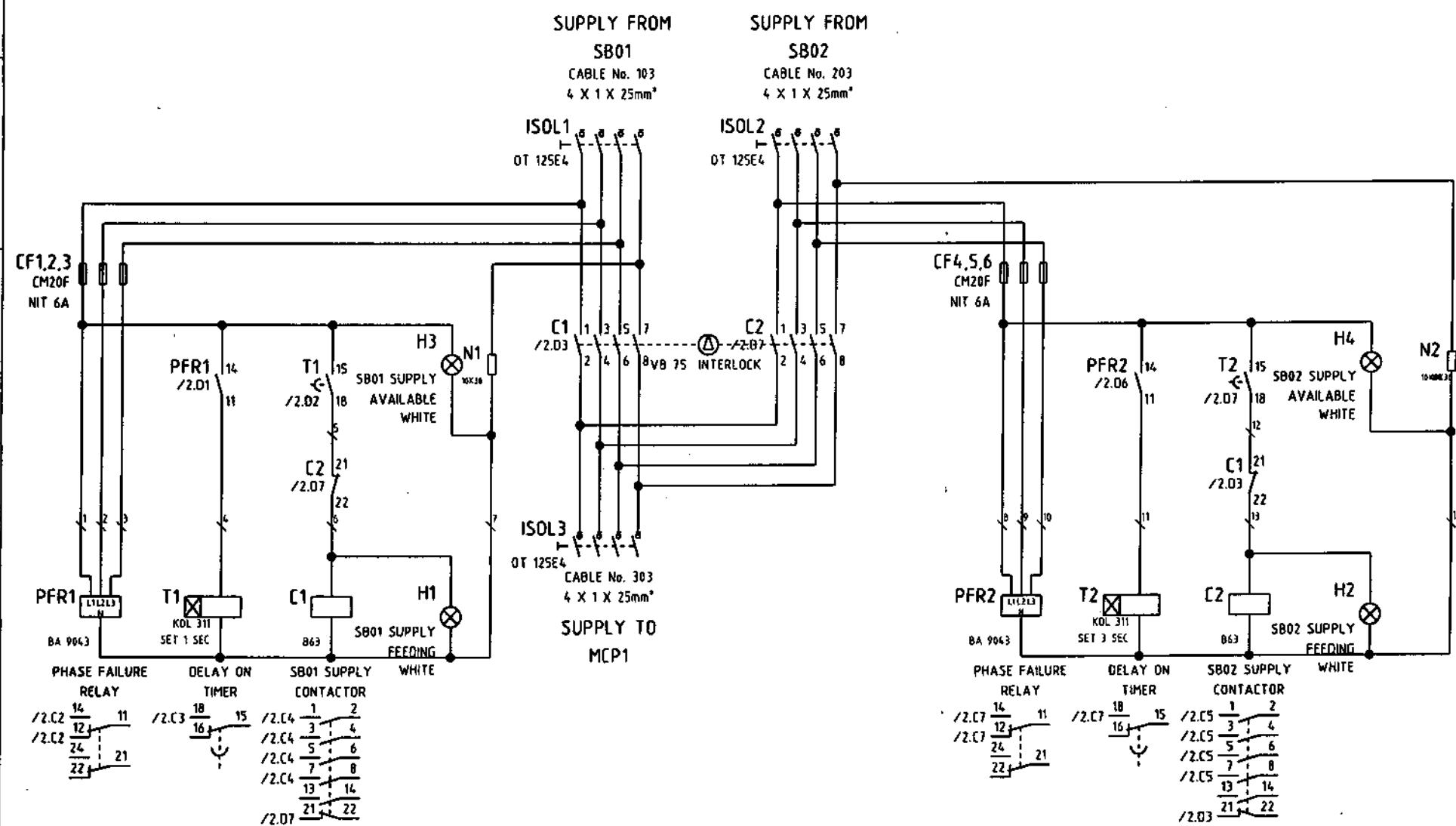
Title
MCP1 AUTO C/O (100A)
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
4390/D/1

Revision
Sheet
1
of

1 2 3 4 5 6 7 8



CERTIFIED FINAL

DATE: 21.10.1998

A-7

Name	Date
Brown J. McEVoy	17-09-98
Chkd	
App'd	

Project
5-7 CARLTON GARDENS
LONDONTitle
MCP1 AUTO C/O (100A)
POWER SCHEMATICClient
T. CLARKE PLC
CONSULTANT
OVE ARUP & PARTNERSDrawing No.
4390/D/2
2Revision
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1 2 3 4 5 6 7 8

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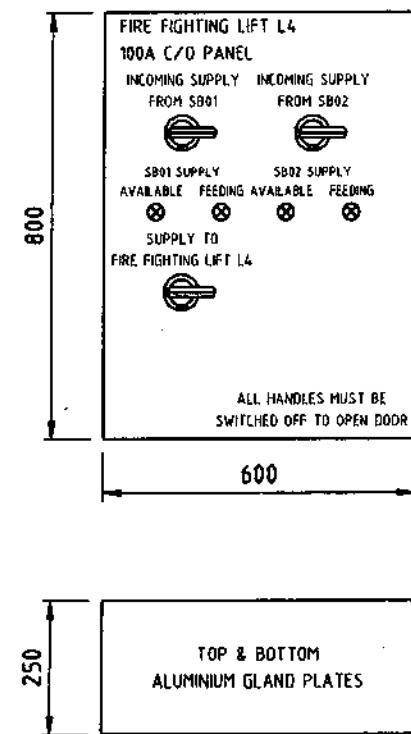
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ST6-825 ETA ENCLOSURE
IP 65 TOP ENTRY BOTTOM EXIT
WALL MOUNTED



CERTIFIED FINAL

DATE: 21.10.1998

A.T

Name	Date	
Drawn J. McEVY	17-09-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

Title
FIREFIGHTING L4 AUTO C/D (100A)
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
4390/E/1
of

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Sheet
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of

1 2 3 4 5 6 7 8

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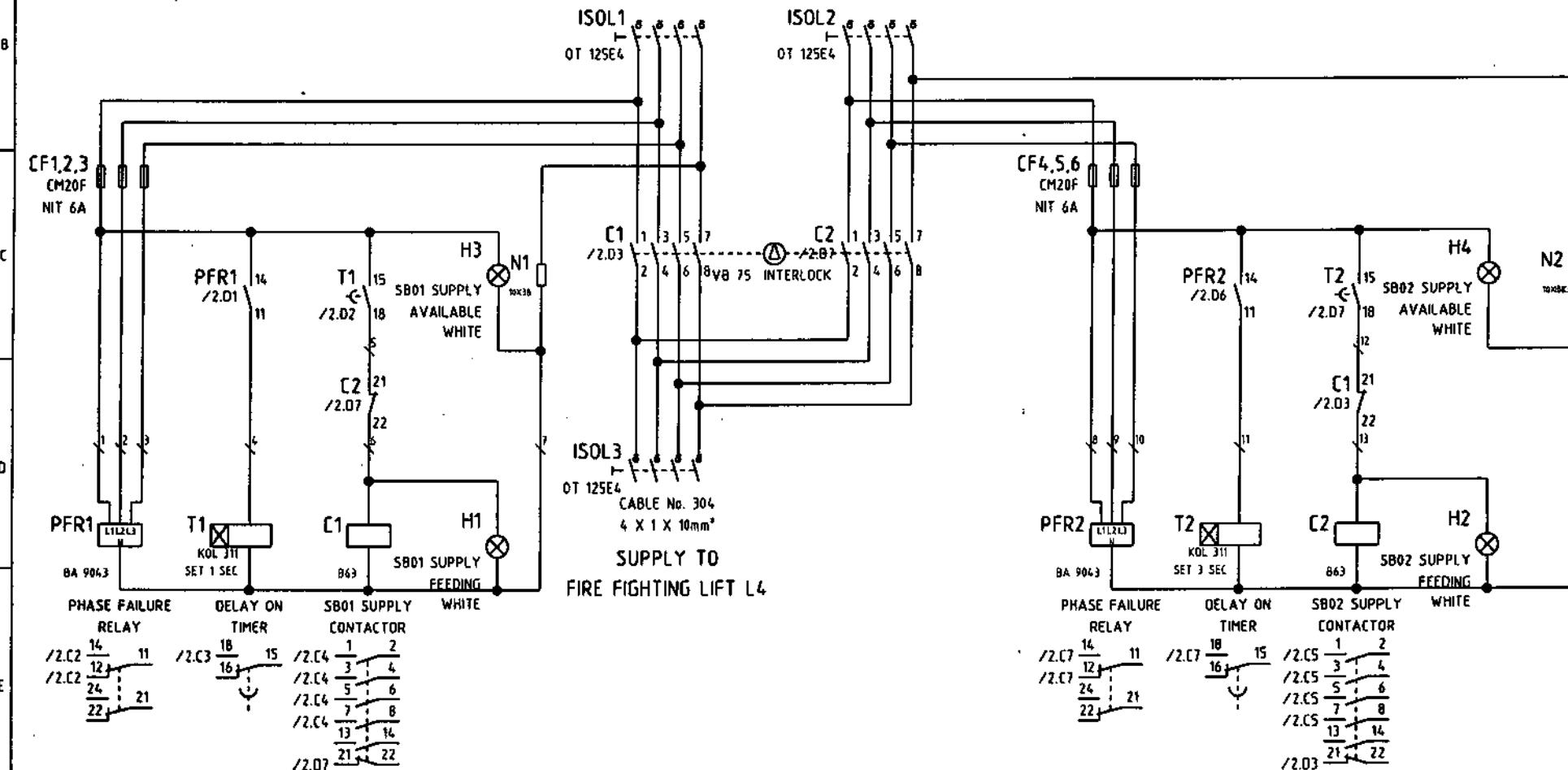
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SB01

CABLE No. 104
4 X 1 X 10mm²

SUPPLY FROM

SB02

CABLE No. 204
4 X 1 X 10mm²

CERTIFIED FINAL

DATE: 21.10.1998 A.T



Project
5-7 CARLTON GARDENS
LONDON

Title
FIREFIGHTING L4 AUTO C/O (100A)
POWER SCHEMATIC

Client

T. CLARKE PLC

CONSULTANT

DOVE ARUP & PARTNERS

Drawing No.

4390/E/2

Revision

2

of

1 2 3 4 5 6 7 8

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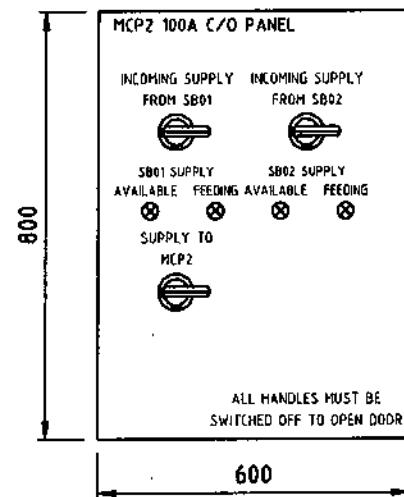
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ST6-825 ETA ENCLOSURE
IP 65 TOP ENTRY BOTTOM EXIT
WALL MOUNTED



CERTIFIED FINAL

DATE: 21.10.1998 A.T



Project
5-7 CARLTON GARDENS
LONDON

Title
MCP2 AUTO C/O (100A)
GENERAL ARRANGEMENT

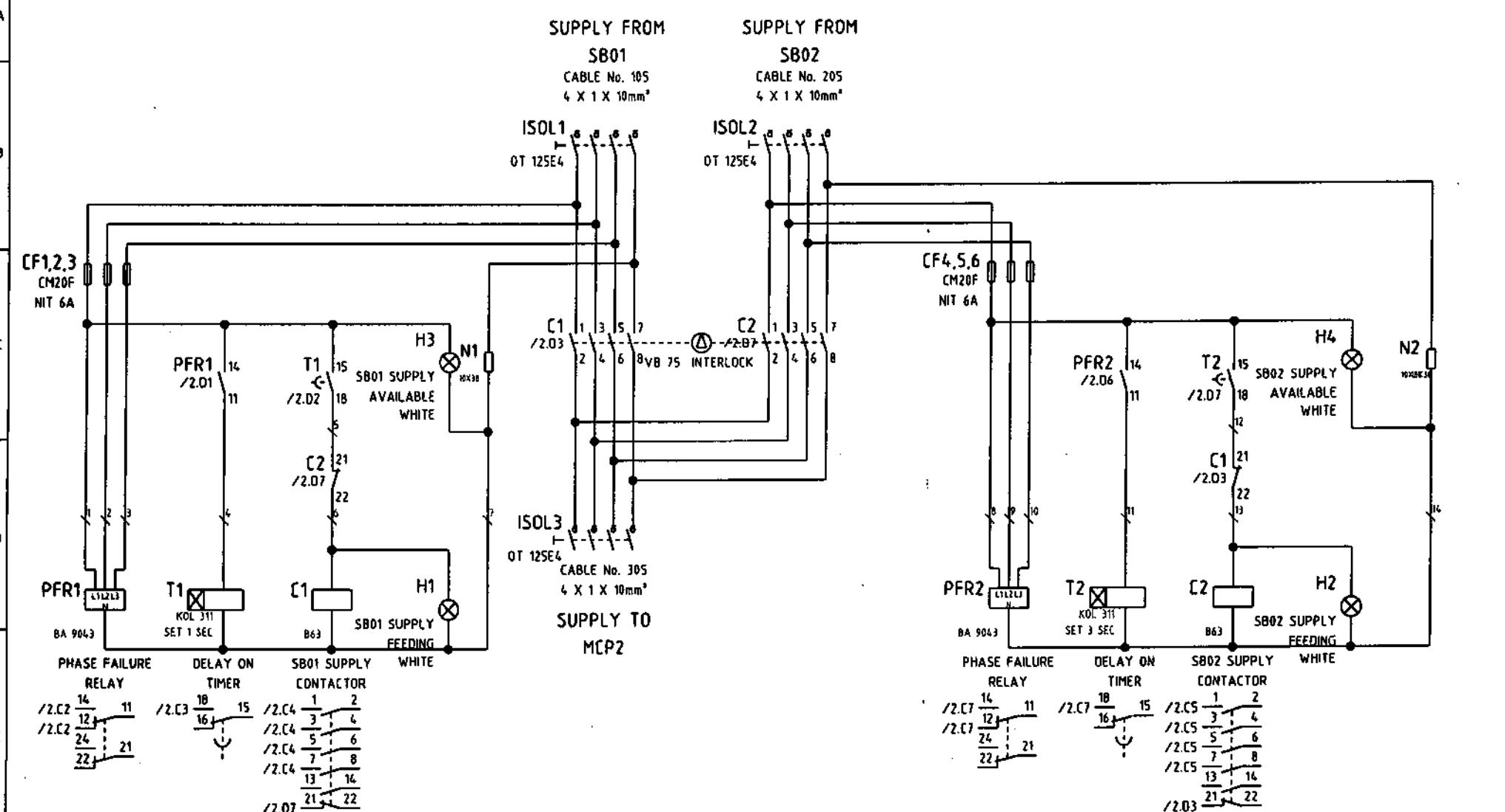
Client
T. CLARKE PLC
CONSULTANT
DOE ARUP & PARTNERS

Drawing No.
4390/F/1

Revision
Sheet
1
of

	Name	Date	
Drawn	J. MCLEVOY	17-09-98	
Chkd			
App'd			

1 2 3 4 5 6 7 8

**CERTIFIED FINAL**

DATE: 21.10.1998 A-T


 Project
 5-7 CARLTON GARDENS
 LONDON

 Title
 MCP2 AUTO C/O (100A)
 POWER SCHEMATIC

 Client
 T. CLARKE PLC

 CONSULTANT
 DVE ARUP & PARTNERS

 Drawing No.
 4390/F/2

 Revision
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Name	Date
Drawn J. McEVoy	17-09-98
Chkd	
App'd	

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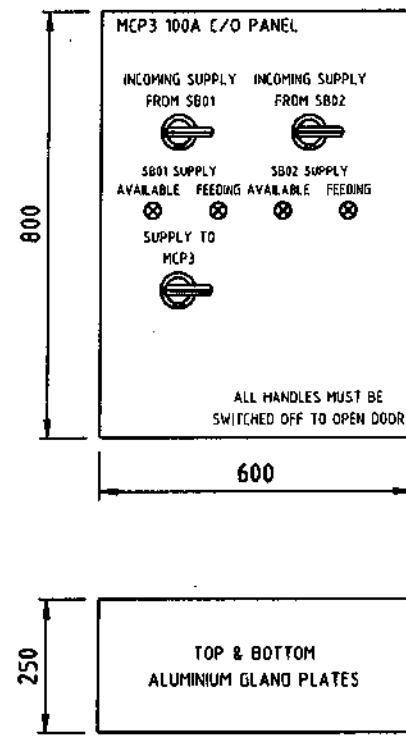
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ST6-825 ETA ENCLOSURE
IP 65 TOP ENTRY BOTTOM EXIT
WALL MOUNTED



CERTIFIED FINAL

DATE: 21.10.1998 A.T

	Name	Date	
Drawn	J. McEVOLY	17-09-98	
Chkd			
App'd			



Project
S-7 CARLTON GARDENS
LONDON

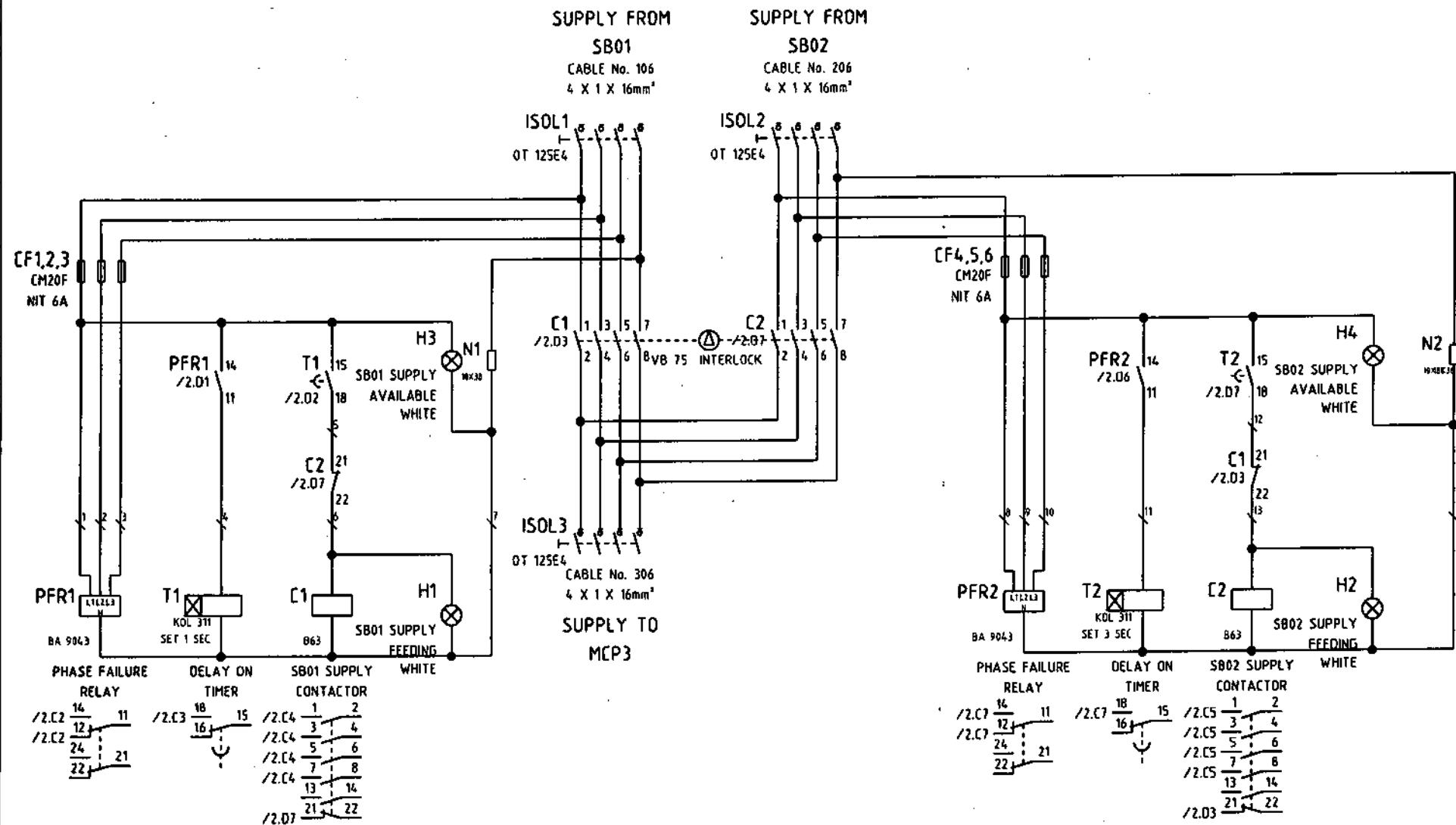
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MCP3 AUTO C/D (100A)
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
DVE ARUP & PARTNERS

Drawing No.
4390/G/1

Revision
Sheet
1
of

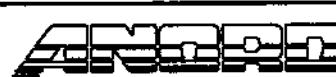


CERTIFIED FINAL

DATE: 21.10.1998

A.T.

	Name	Date	
Drawn	J. McEVoy	17-09-98	
Chkd			
Acc'd			



Project
S-7 CARLTON GARDENS
LONDON

Title
MCP3 AUTO C/D 1100A
POWER SCHEMATIC

Client
F. CLARKE PL

Drawing No.
4390/G/

Revision Sheet 2

1 2 3 4 5 6 7 8

ANORD/STROMBERG SWITCHGEAR, DEPTH 1300mm

HORIZONTAL BUSBAR MOZR2000 100% NEUTRAL 50kA /1 sec

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PROTECTION RATING IP 31 FORM 4 TYPE 5

COLOUR: GREY RAL 7032.

BOTTOM ENTRY TOP EXIT

MOZR 800 C

MOZR 2x100x10

MDZR 800S

101.6X6.3

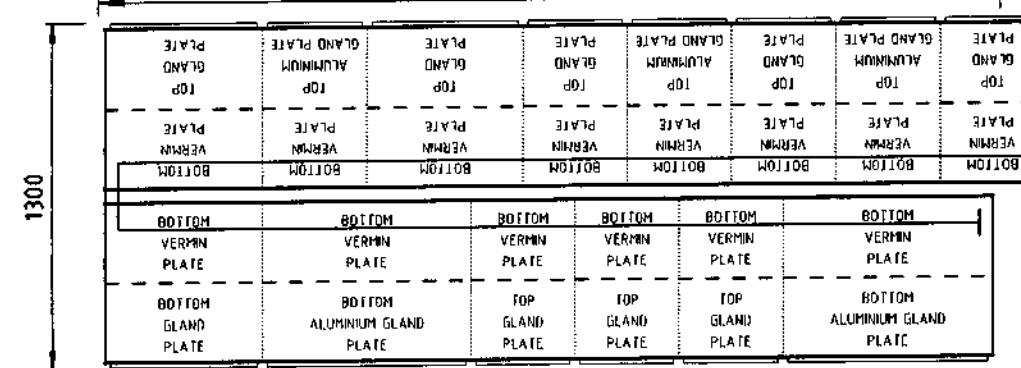
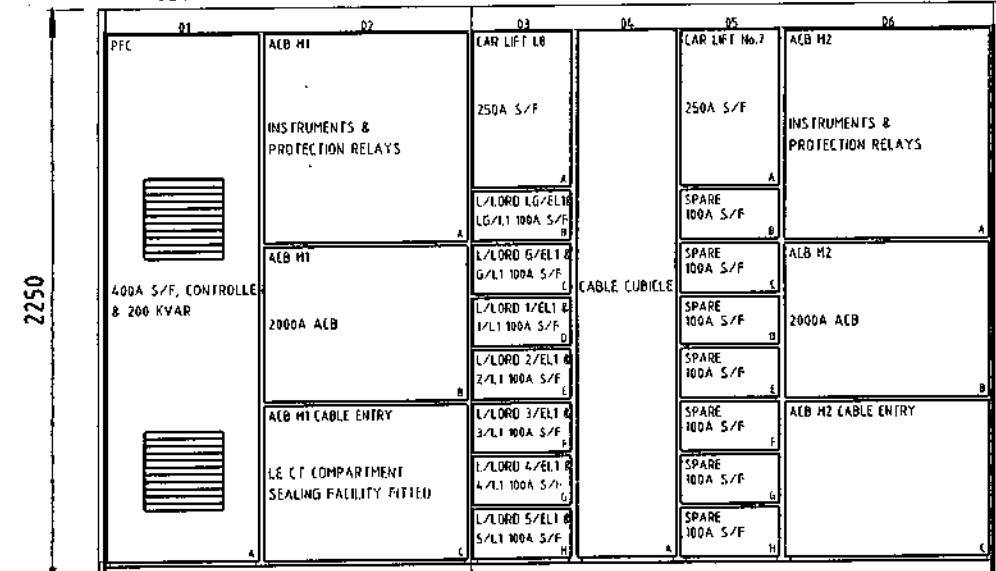
TINNED BB

MDZR 800S

101.6X6.3

TINNED BB

MOZR 2x100x10



CONTROL CABLE COLOURS

230/110/24 VAC AUX CCTS BLACK
30VDC + BROWN 30VDC - BLUE
BMS GREY

CERTIFIED FINAL

DATE: 01.12.1998

CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

Name	Date		Project	Site	Drawing No.	Revision	Sheet
Drawn J. McLEODY	12-09-98		5-7 CARLTON GARDENS LONDON	SB 01 GENERAL ARRANGEMENT	556/A/1	A	1
Checked							
Approved							



SIDE A LE ROOM

CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Drawn	J. McEVOY	12-08-79	
Checked			
Approved			



Project
5-7 CARLTON GARDENS
LONDON

Line
SB 01
GENERAL ARRANGEMENT

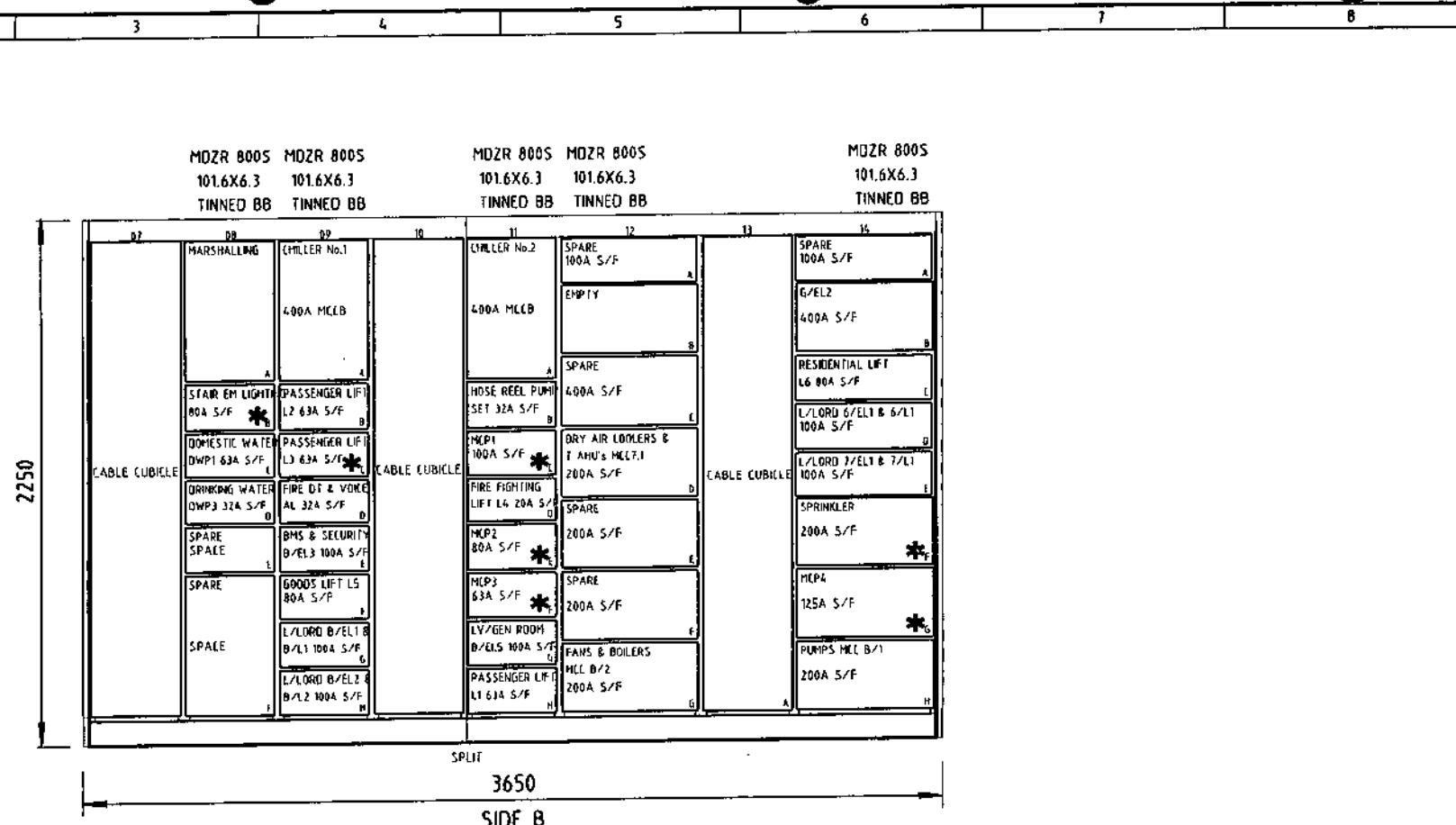
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T. CLARKE PLE

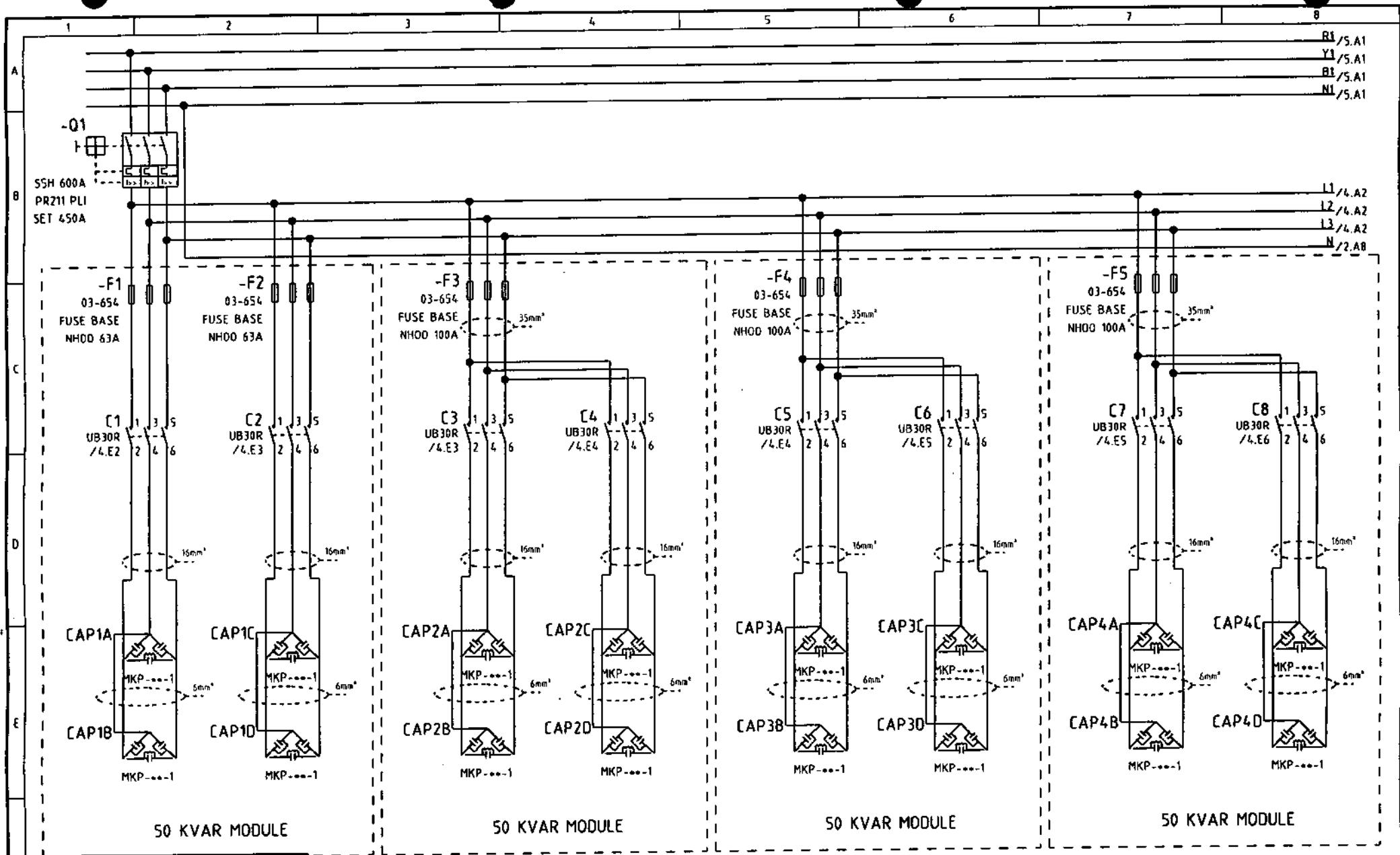
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DOVE ARUP & PARTNERS**

Drawing No.
558/A/

140

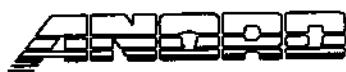
Revision A Sheet 1 of





CERTIFIED FINAL

DATE: 01.12.1998



Project
5-7 CARLTON GARDENS
LONDON

Title
SB 01
POWER SCHEMATIC
200KVAR POWER FACTOR

Client
T. CLARKE PLC

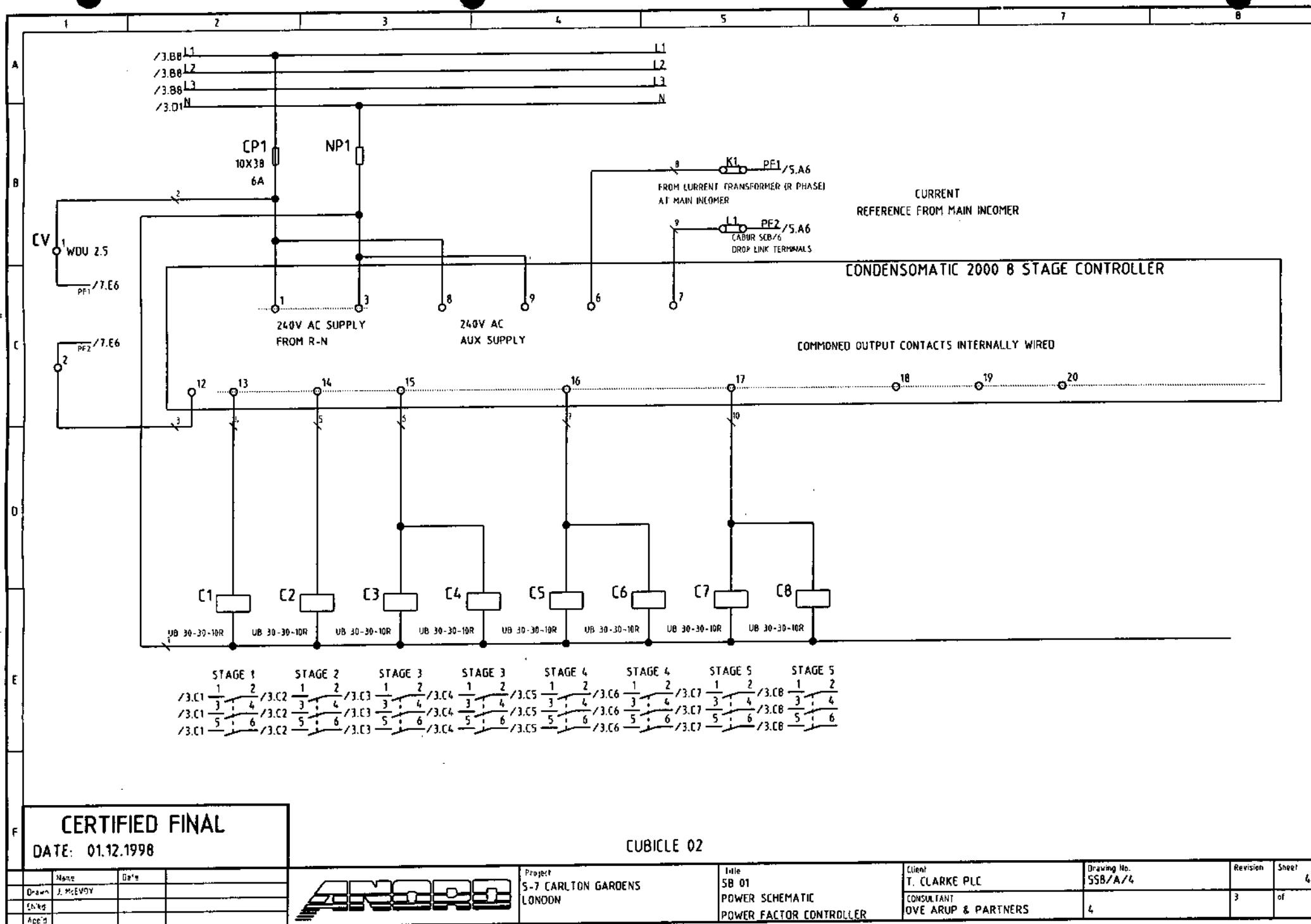
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OVE ARUP & PARTNERS

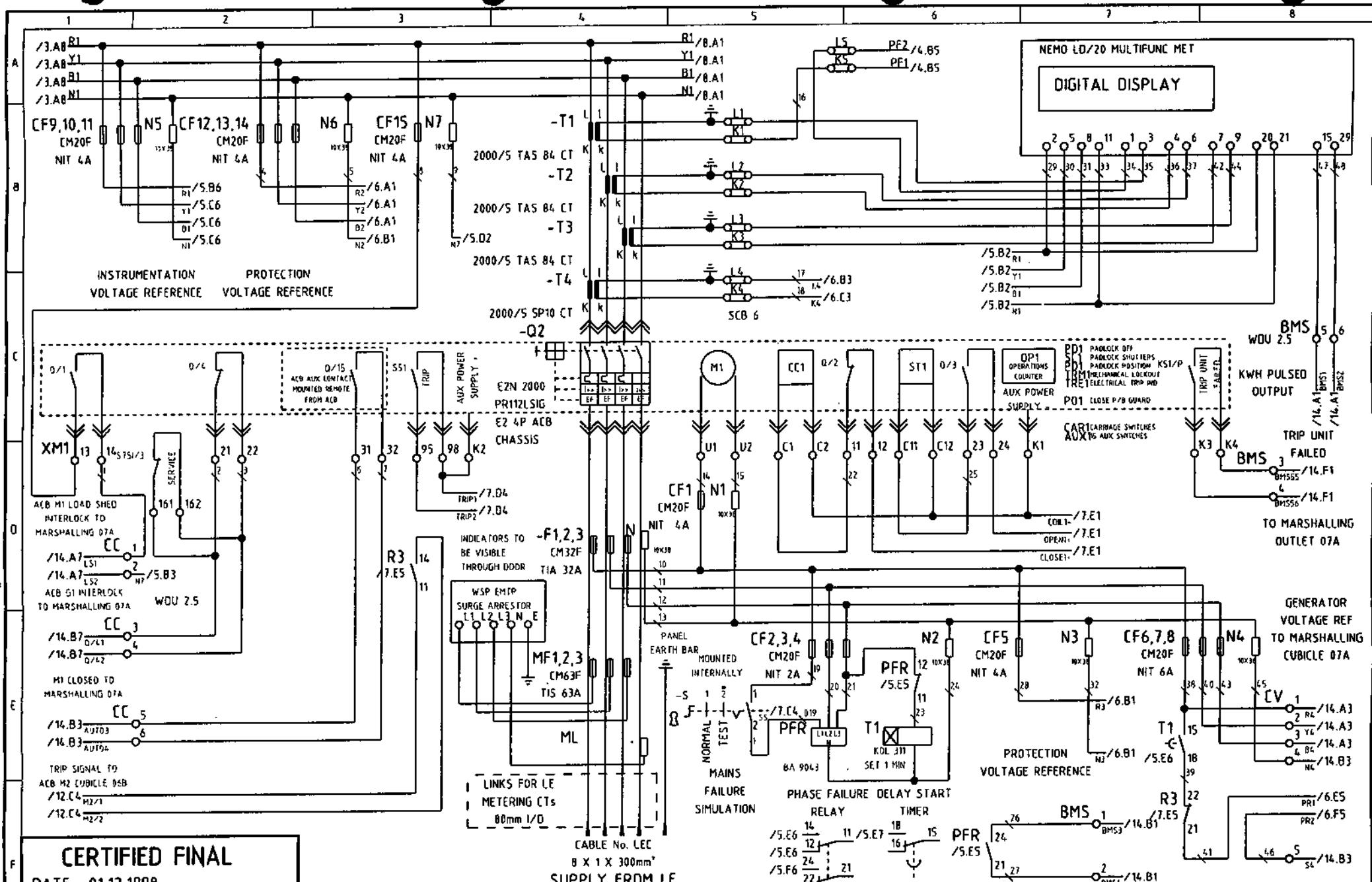
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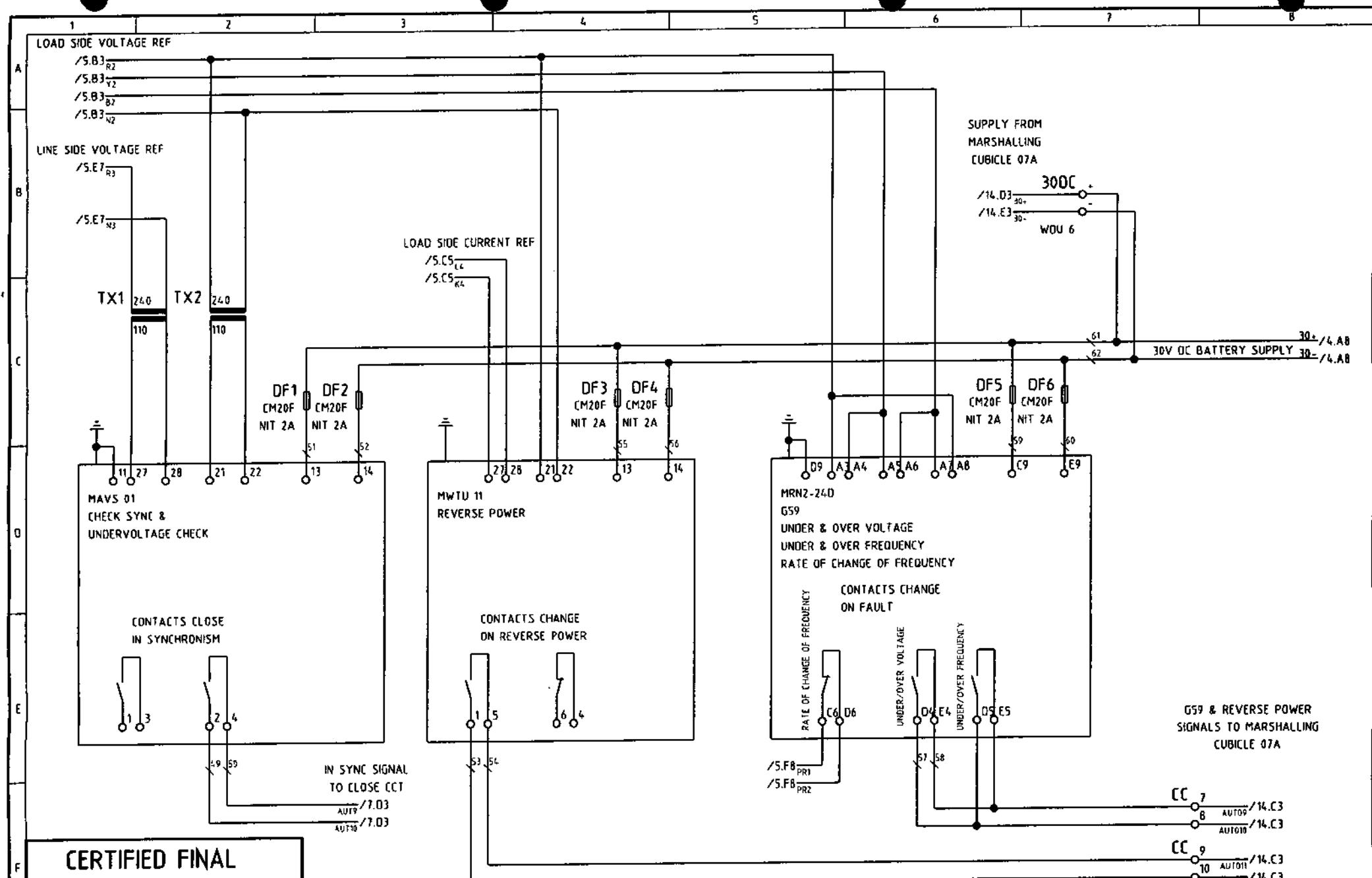
Revision
2

Sheet
3

Name	Date	
Drawn J. McEVoy		
Chkd		
Acc'd		



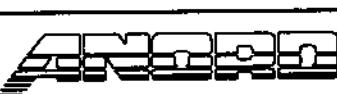




CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Origin	J. McEVYAN		
Child			
Adult			



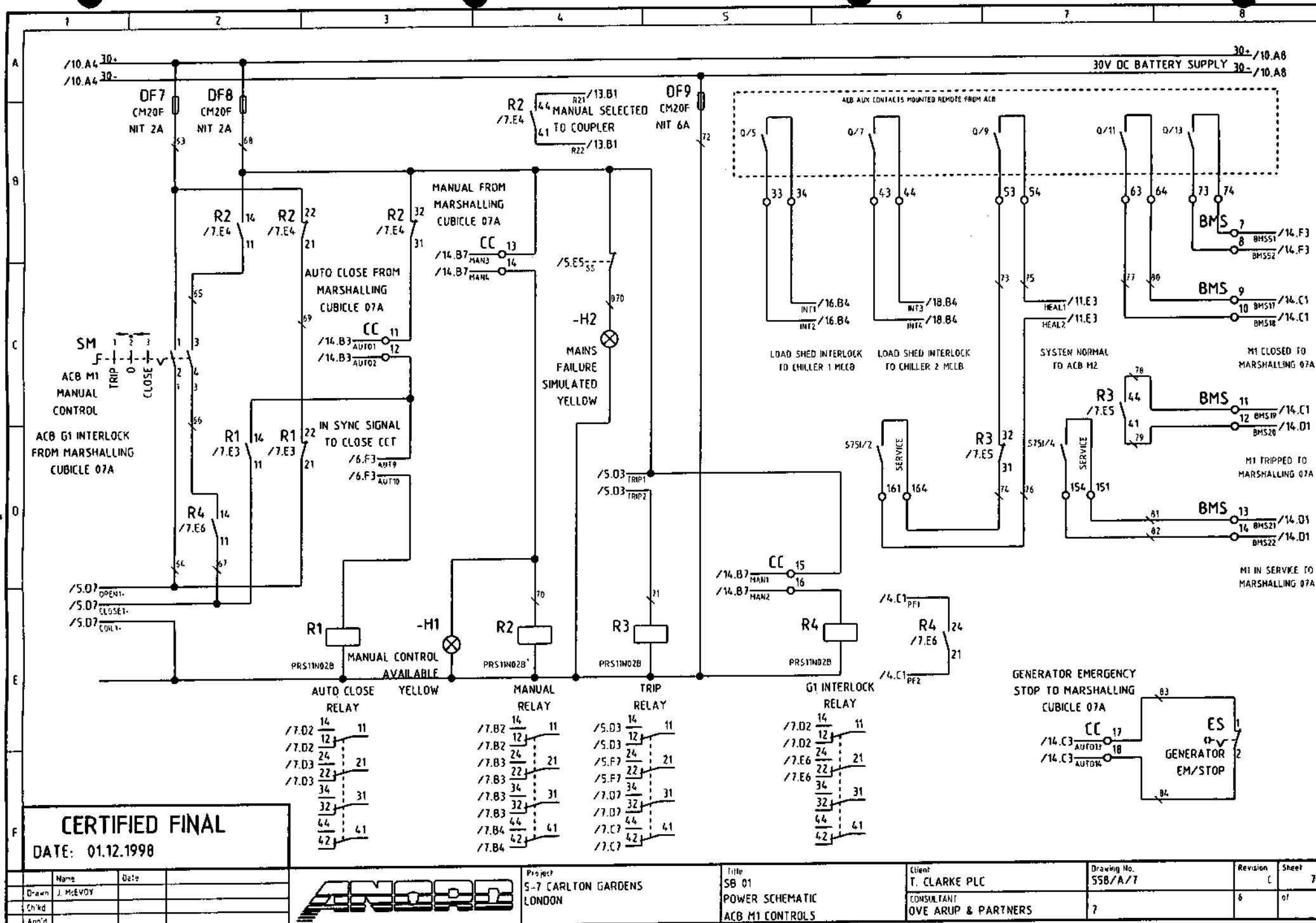
Project
S-7 CARLTON GARDENS
LONDON

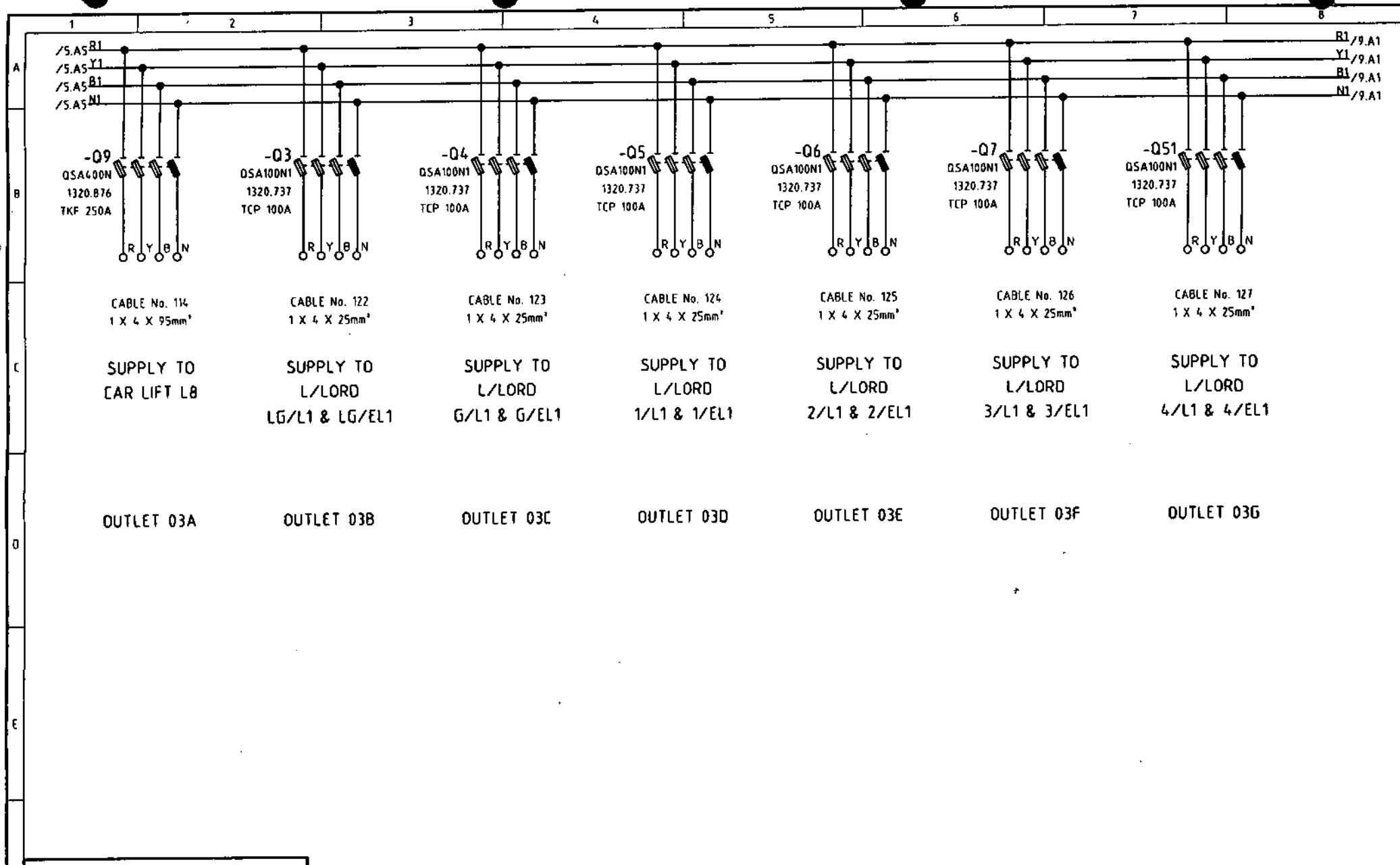
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SB 01
POWER SCHEMATIC
ACB M1 PROTECTION RELAYS

Client
T. CLARKE PLC
CONSULTANT

8

ng No.
A/6



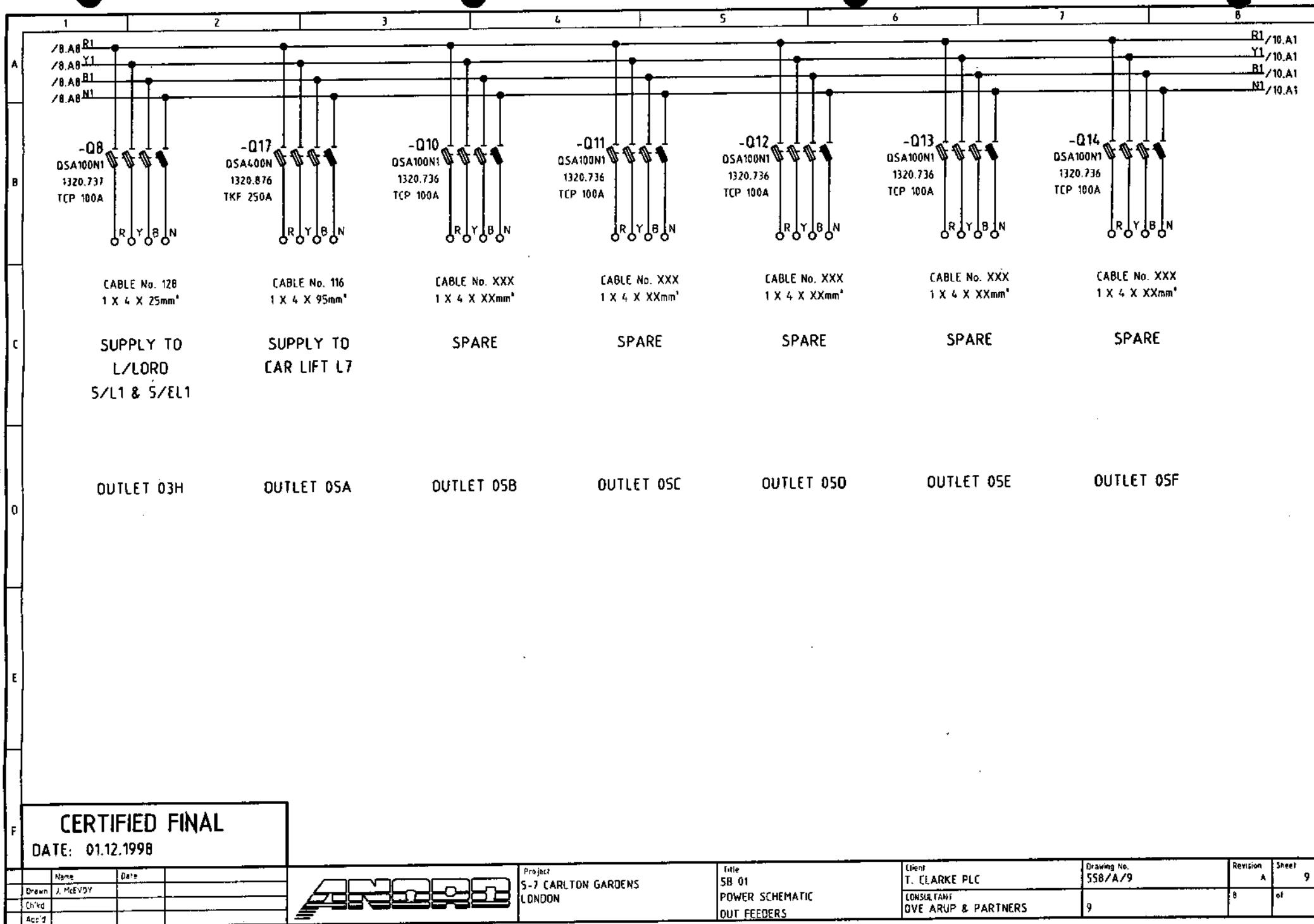


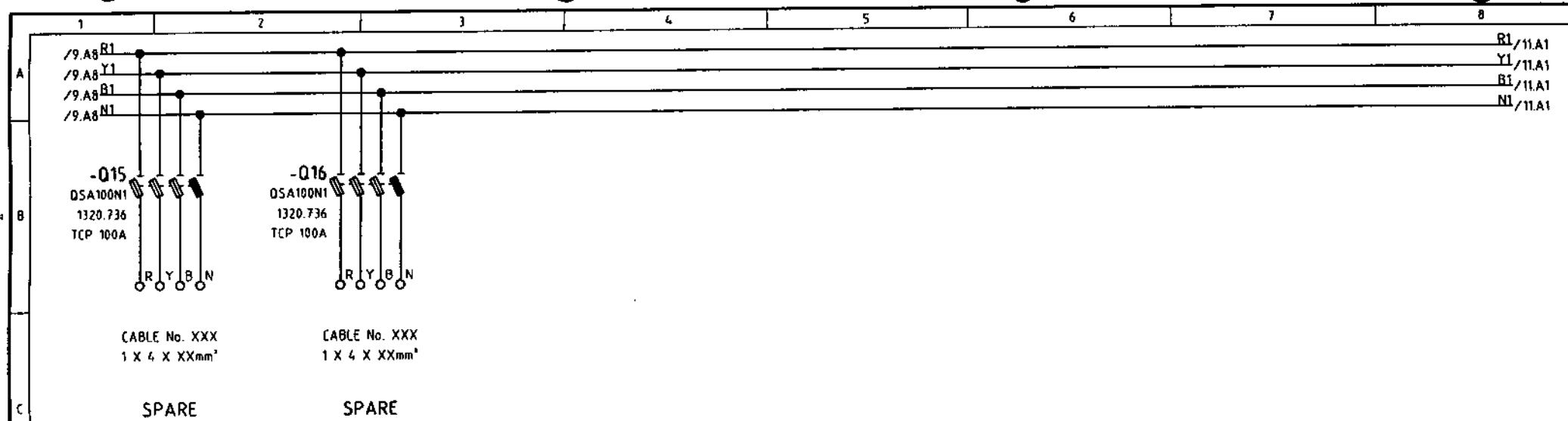
CERTIFIED FINAL

DATE: 01.12.1998

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEvoy		5-7 CARLTON GARDENS LONDON	SB 01 POWER SCHEMATIC OUT FEEDERS	T. CLARKE PLC CONSULTANT DOVE ARUP & PARTNERS	558/A/0	A	8
Chkd						7	of
Acsp'd						8	







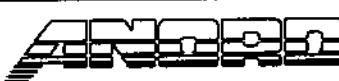
OUTLET 05G

OUTLET 05H

CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Dawn	J. McEVORY		
Links			
Acc'd			



Project
5-7 CARLTON GARDENS
LONDON

File
SB 01
POWER SCHEMATICS
OUT FEEDERS

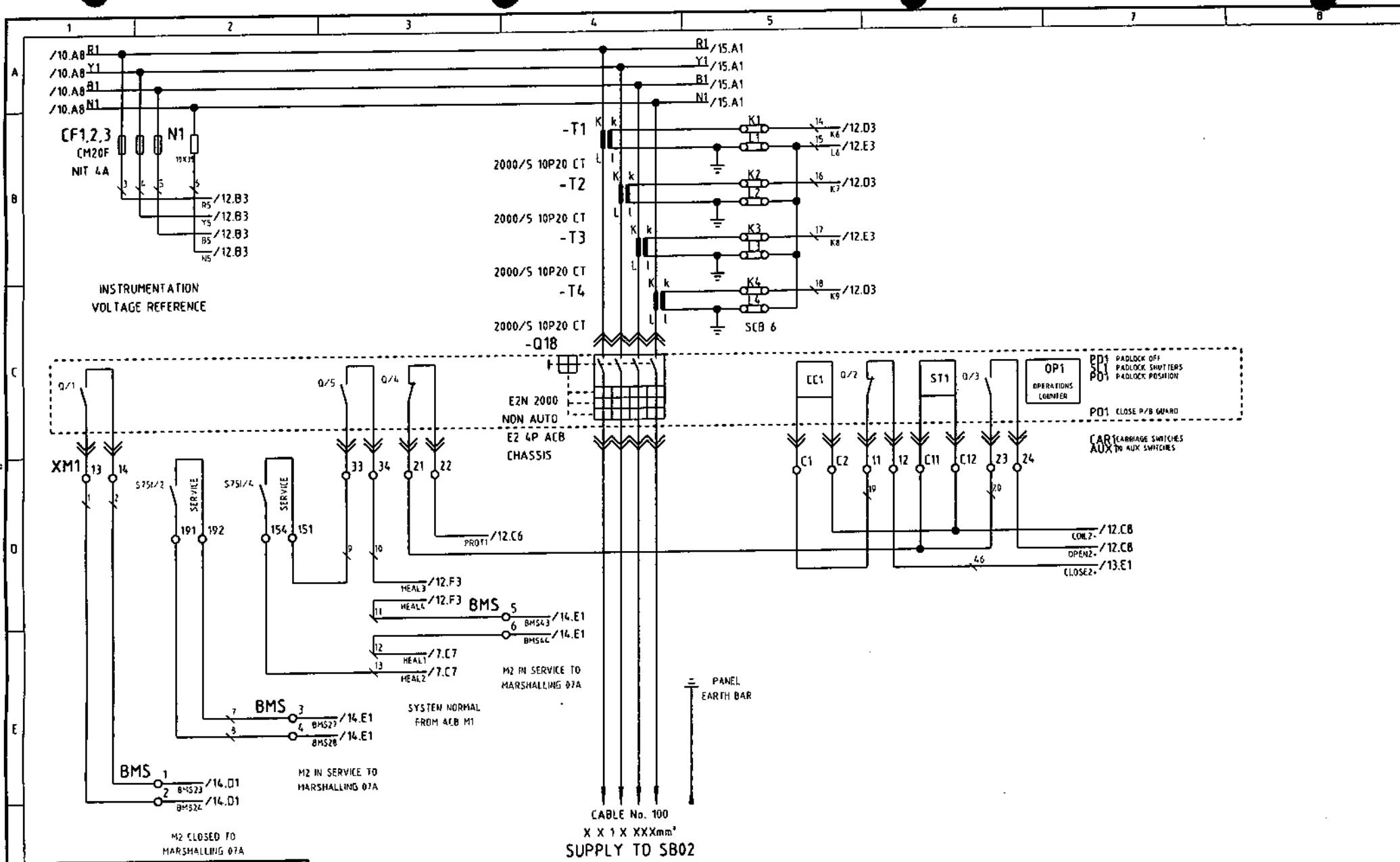
Client
T. CLARKE

CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/A/

— 3 —

Revision A Sheet 10



CERTIFIED FINAL

DATE: 01.12.1998

Name	Date	
Drawn J. MCLEOD		
Checkd		
Acc'd		



Project
5-7 CARLTON GARDENS
LONDON

Title
SB 01
POWER SCHEMATIC
COUPLER ACB M2

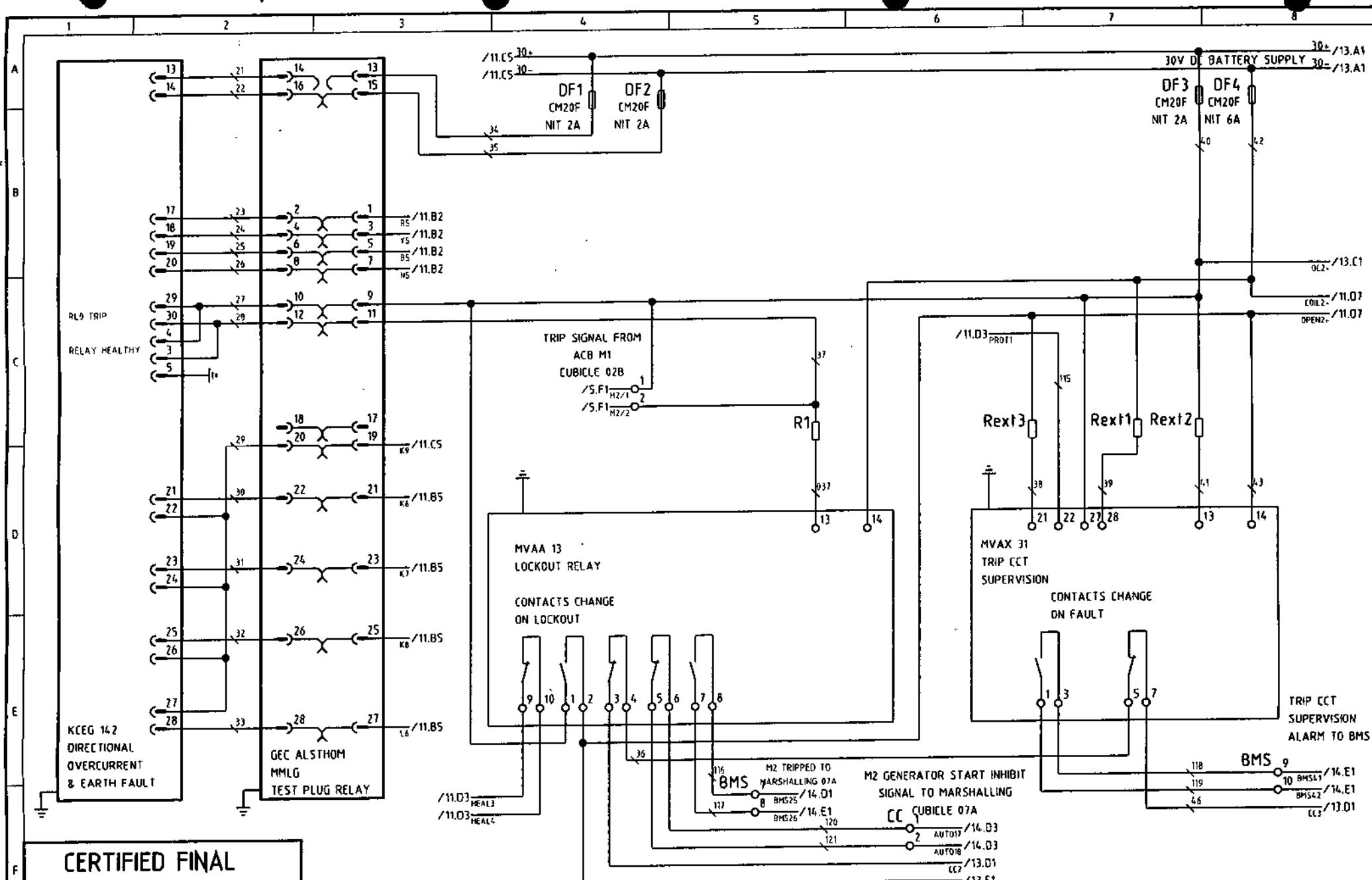
Client
T. CLARKE PLC
Consultant
OVE ARUP & PARTNERS

Drawing No.
558/A/11

Revision
A
Sheet
11

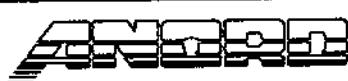
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11



CERTIFIED FINAL

DATE: 01.12.1998



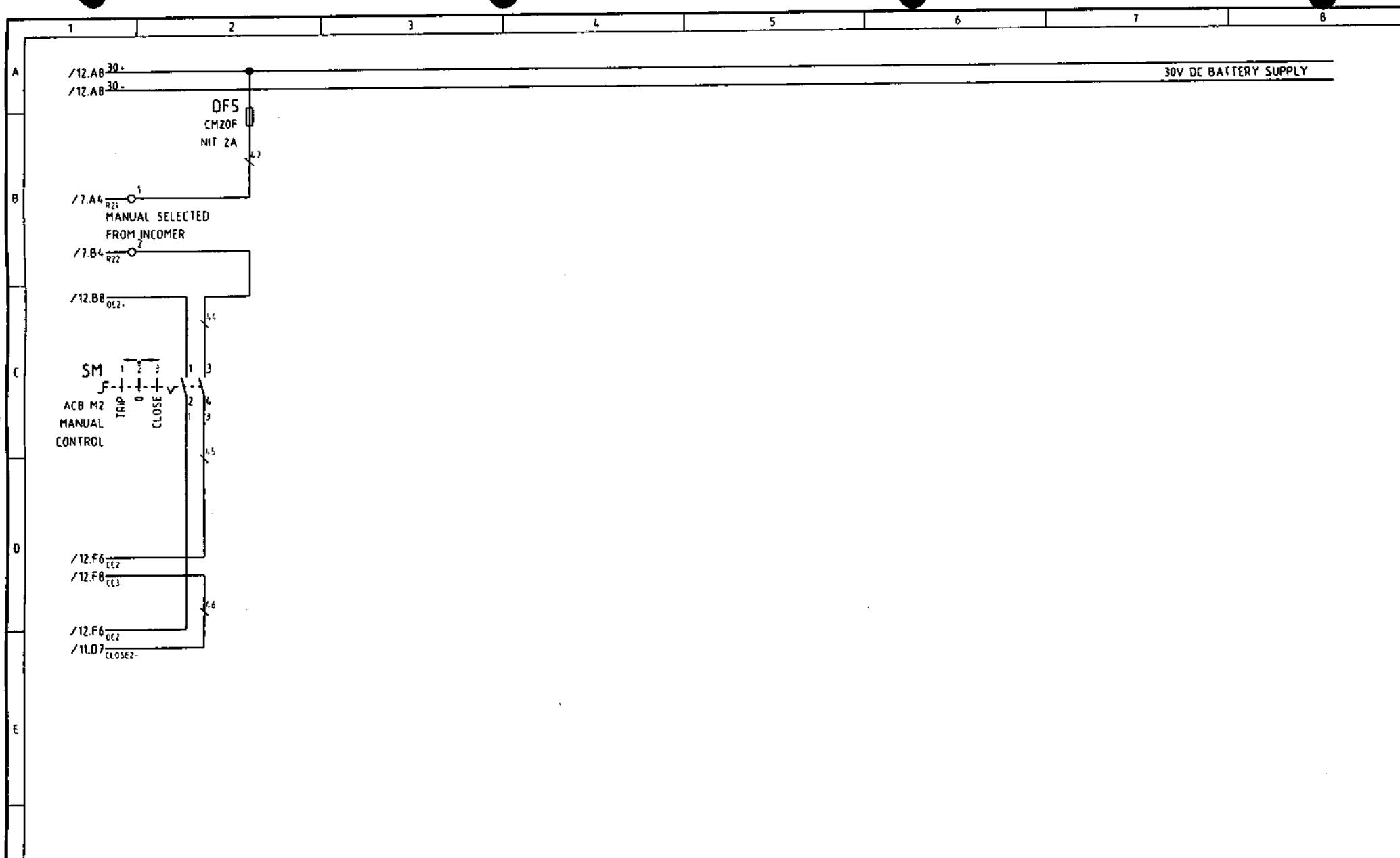
Project
5-7 CARLTON GARDENS
LONDON

Title
SB 01
POWER SCHEMATIC
ACB M2 PROTECTION RELAYS

Client
T. CLARKE PLC
Consultant
DVE ARUP & PARTNERS

Drawing No.
558/A/12

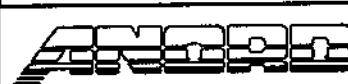
Revision
11
Sheet
12
of



CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Drawn	J. McEvoy		
Entered			
Approved			



Project
S-7 CARLTON GARDENS
LONDON

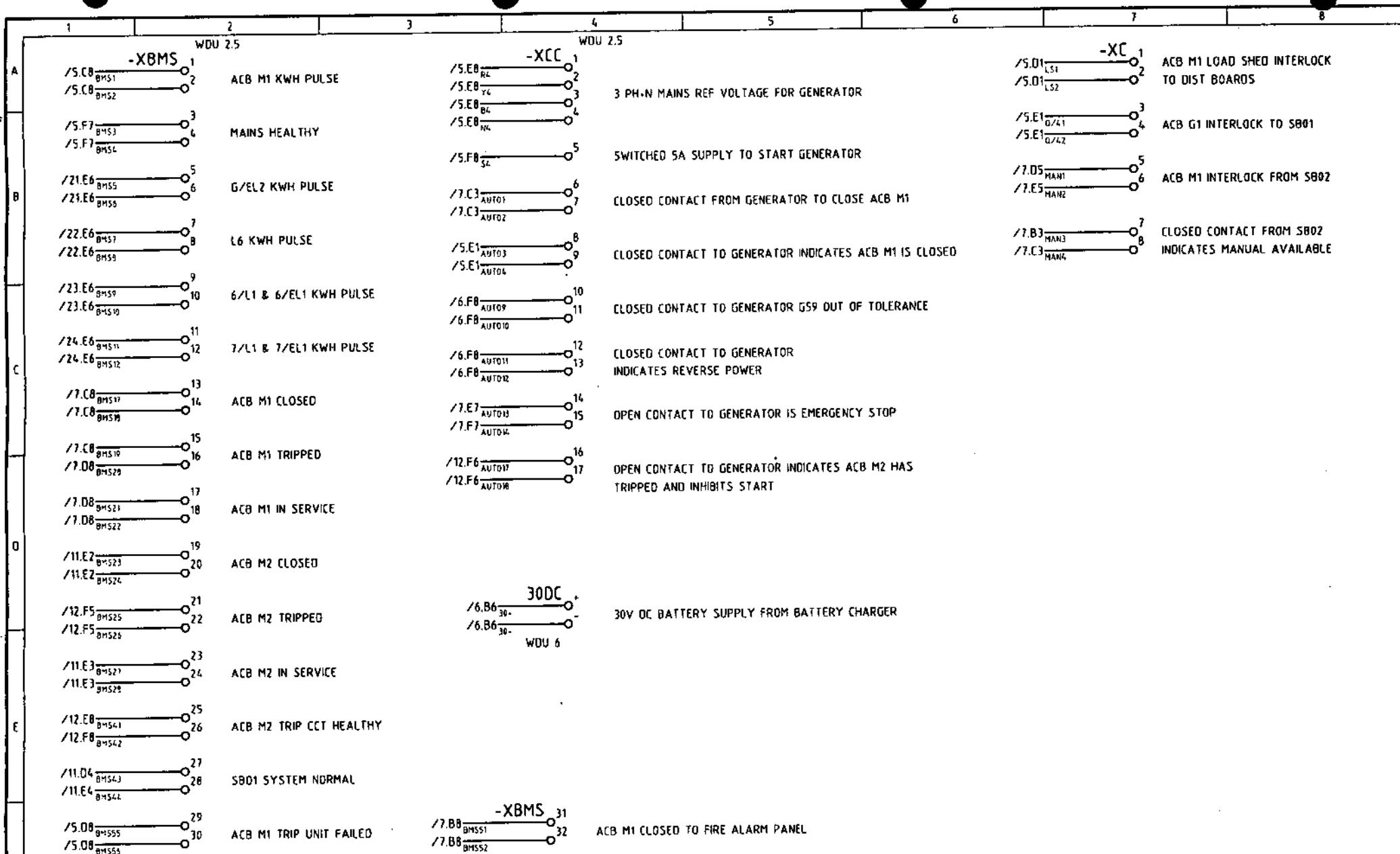
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SB 01
POWER SCHEMATIC
ACB M2 CONTROL

Client
T. CLARKE
CONSULTANT

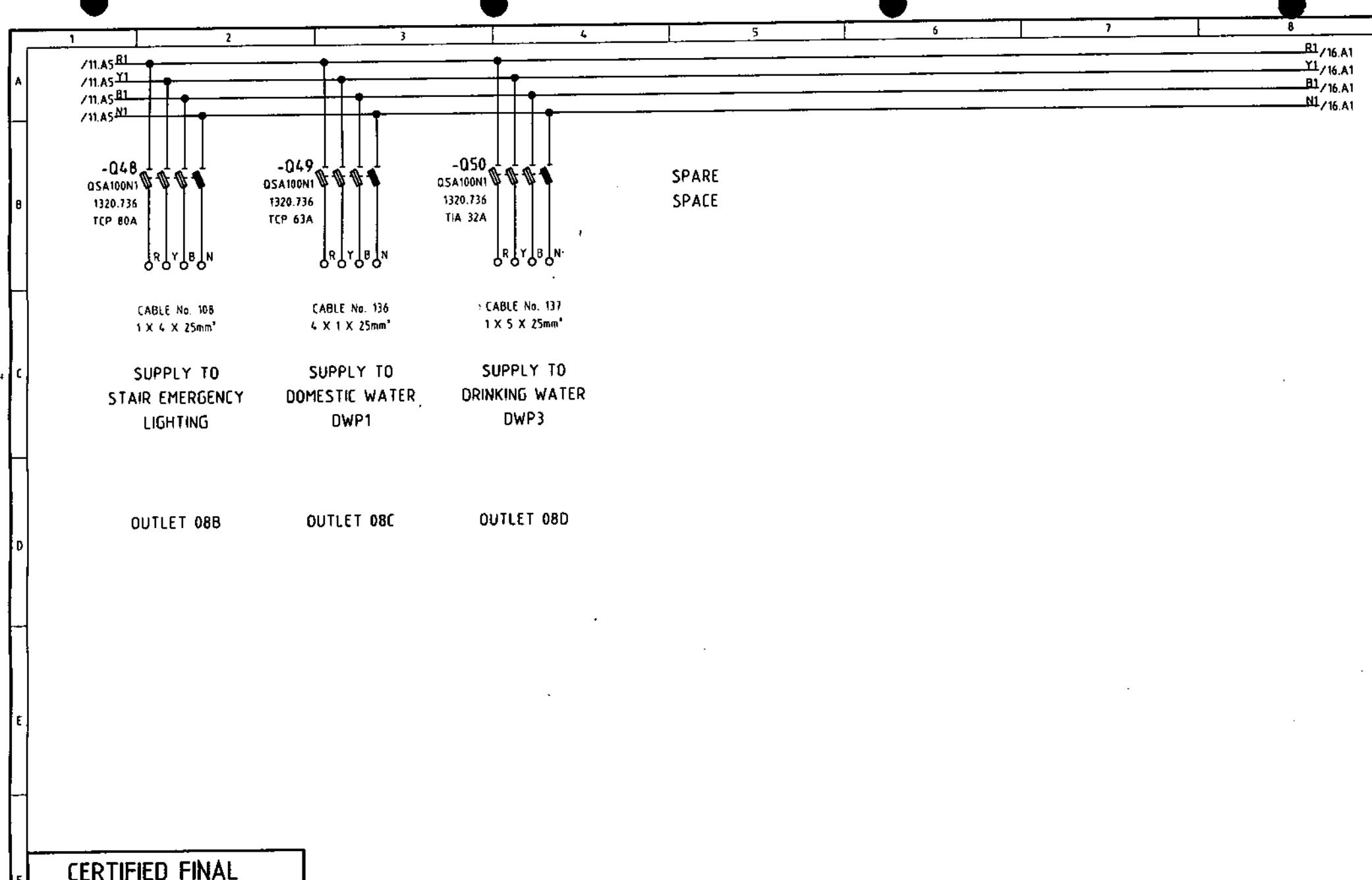
Drawing No.
558/A/1

1

revision
A

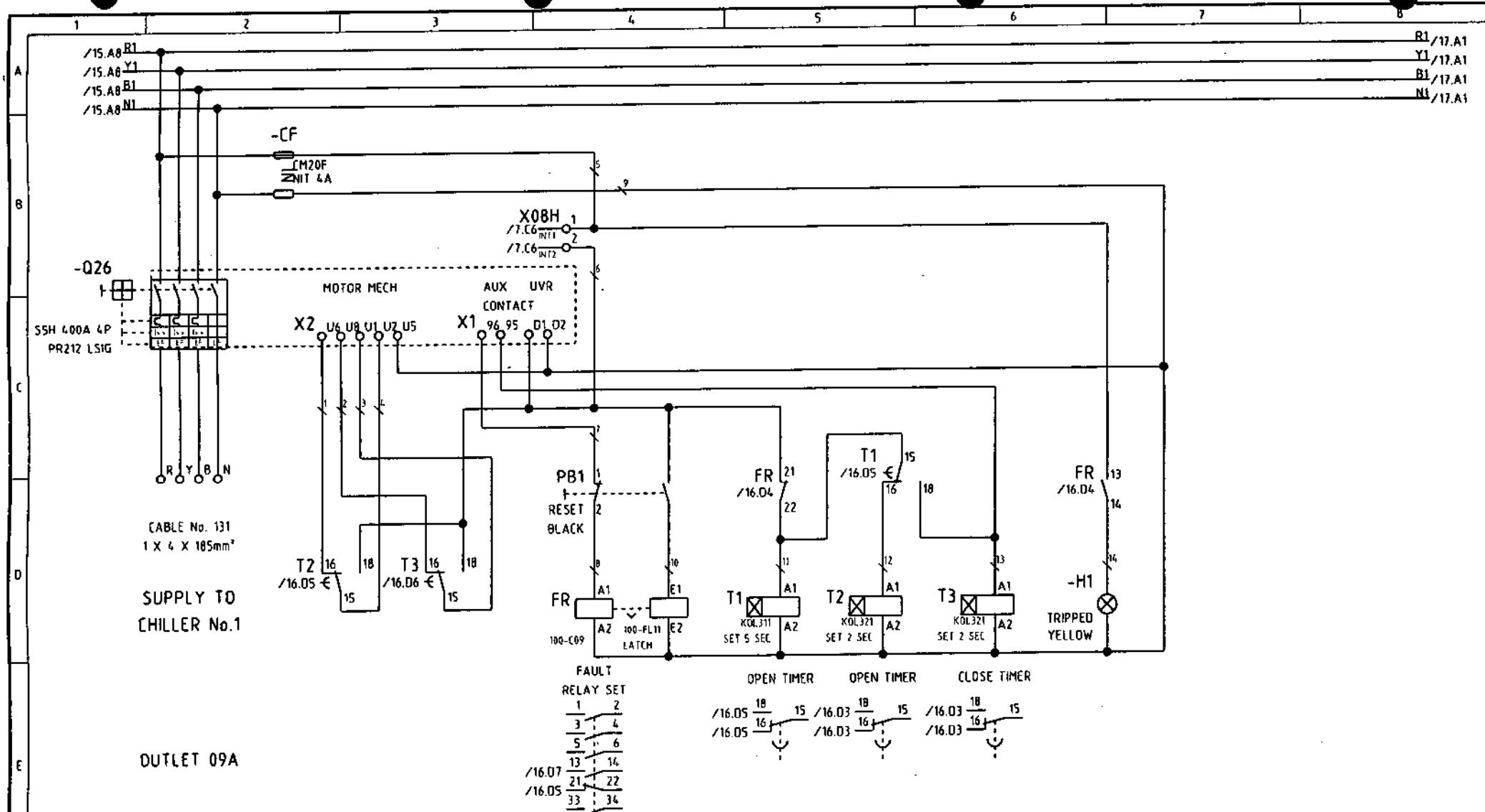


Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEvoy		5-7 CARLTON GARDENS LONDON	SB 01 POWER SCHEMATIC MARSHALLING	T. CLARKE PLC CONSULTANT DOE ARUP & PARTNERS	558/A/14	B	14
Chkd						C	
Act'd						D	



CERTIFIED FINAL

DATE: 01.12.1998



CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Drawn	J. McEVoy		
Checkd			
Acc'd			



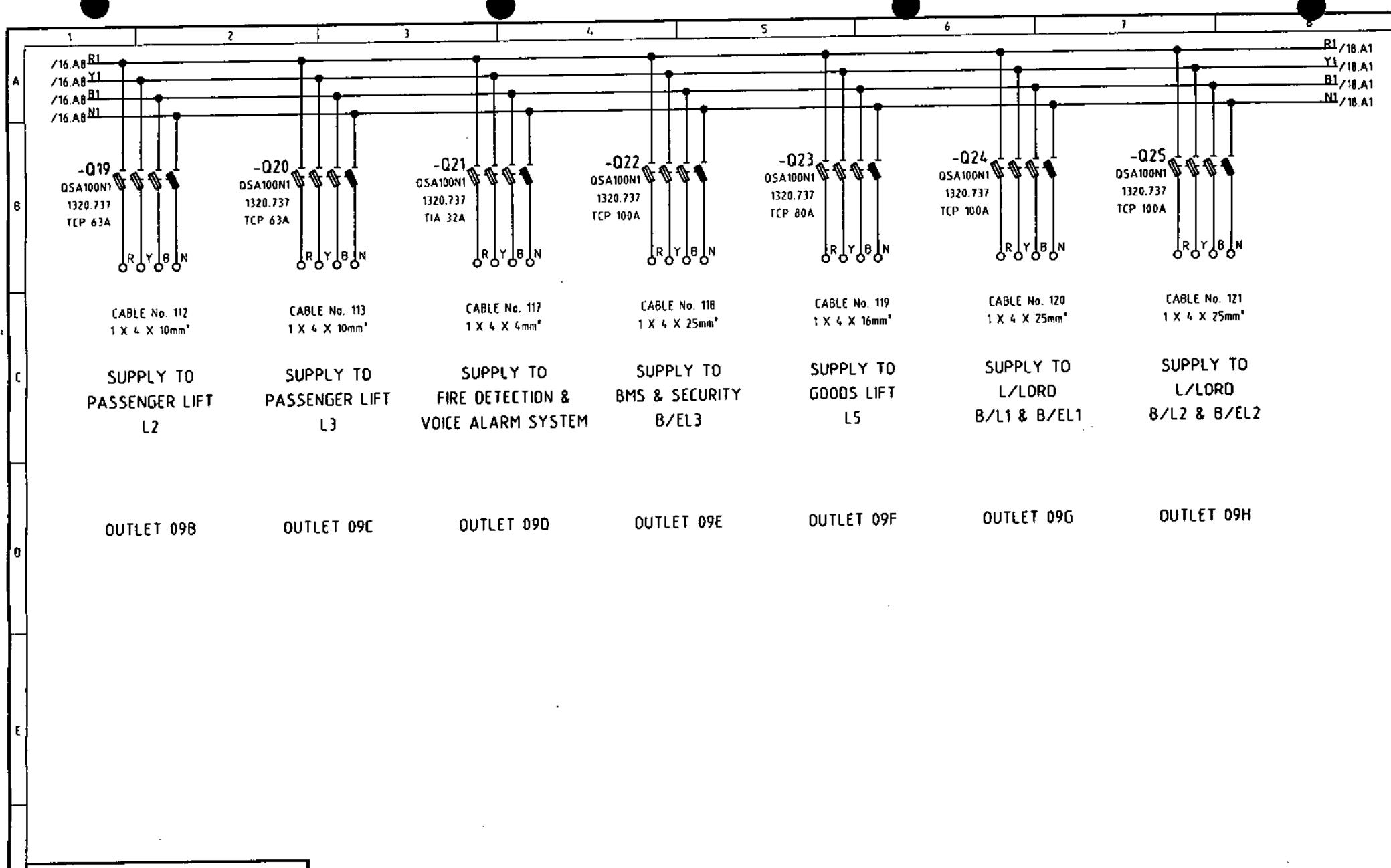
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5-7 CARLTON GARDENS
LONDON

Title
SB 01
POWER SCHEMATIC
OUT FEEDERS

Client
T. CLARKE PLC
Consultant
OVE ARUP & PARTNERS

Drawing No.
558/A/16

Revision B
Sheet 16
of



CERTIFIED FINAL

DATE: 01.12.1998

Name	Date
Drawn J. McEVoy	
Checkd	
Appv'd	



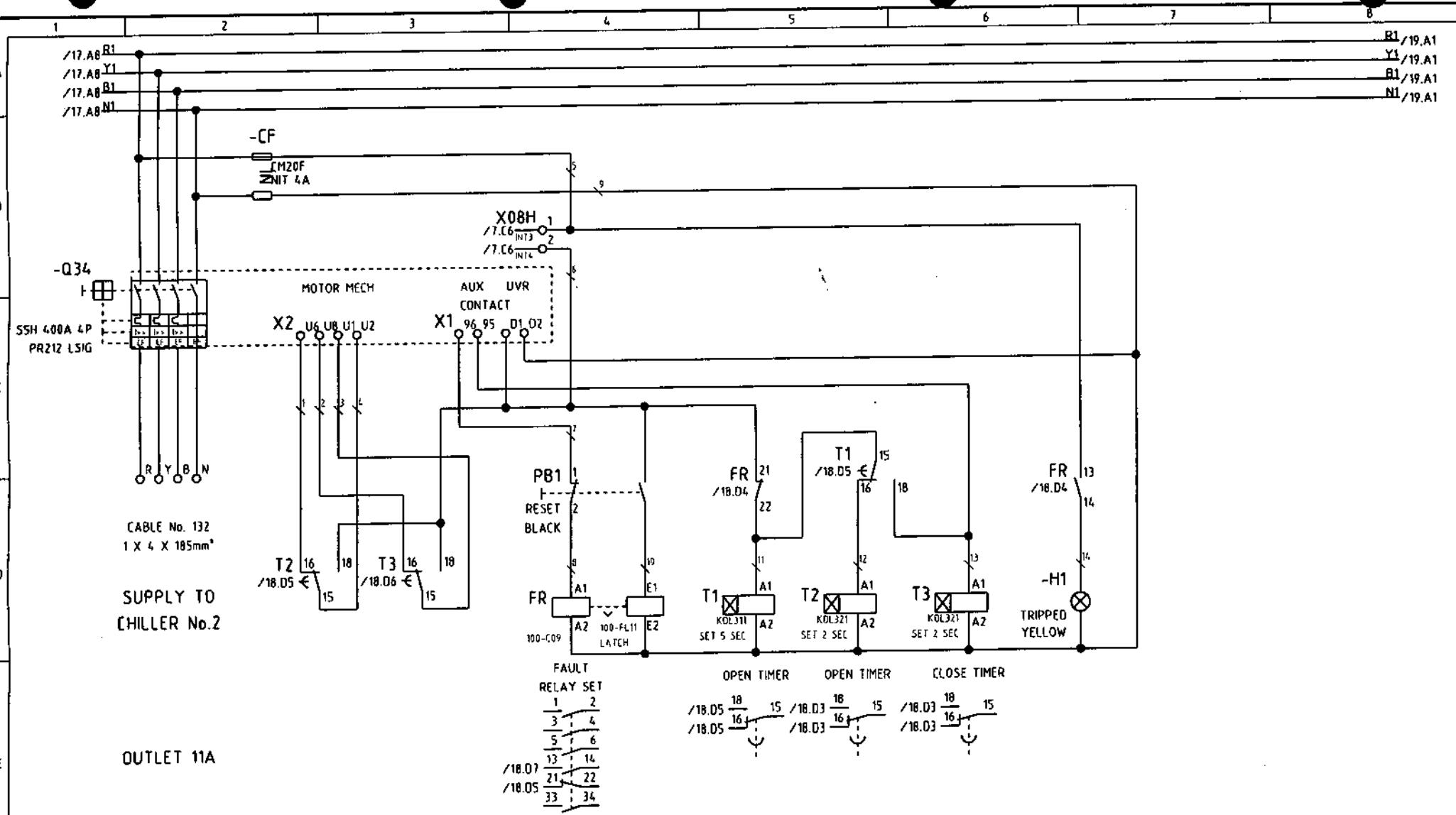
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5-7 CARLTON GARDENS
LONDON

Title
SB 01
POWER SCHEMATIC
OUT FEEDERS

Client
T. CLARKE PLC
CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/A/17

Revision A
16 of 17



CERTIFIED FINAL

DATE: 01.12.1998

Name	Date
Drawn J. McEvoy	
Chkd	
Appd	



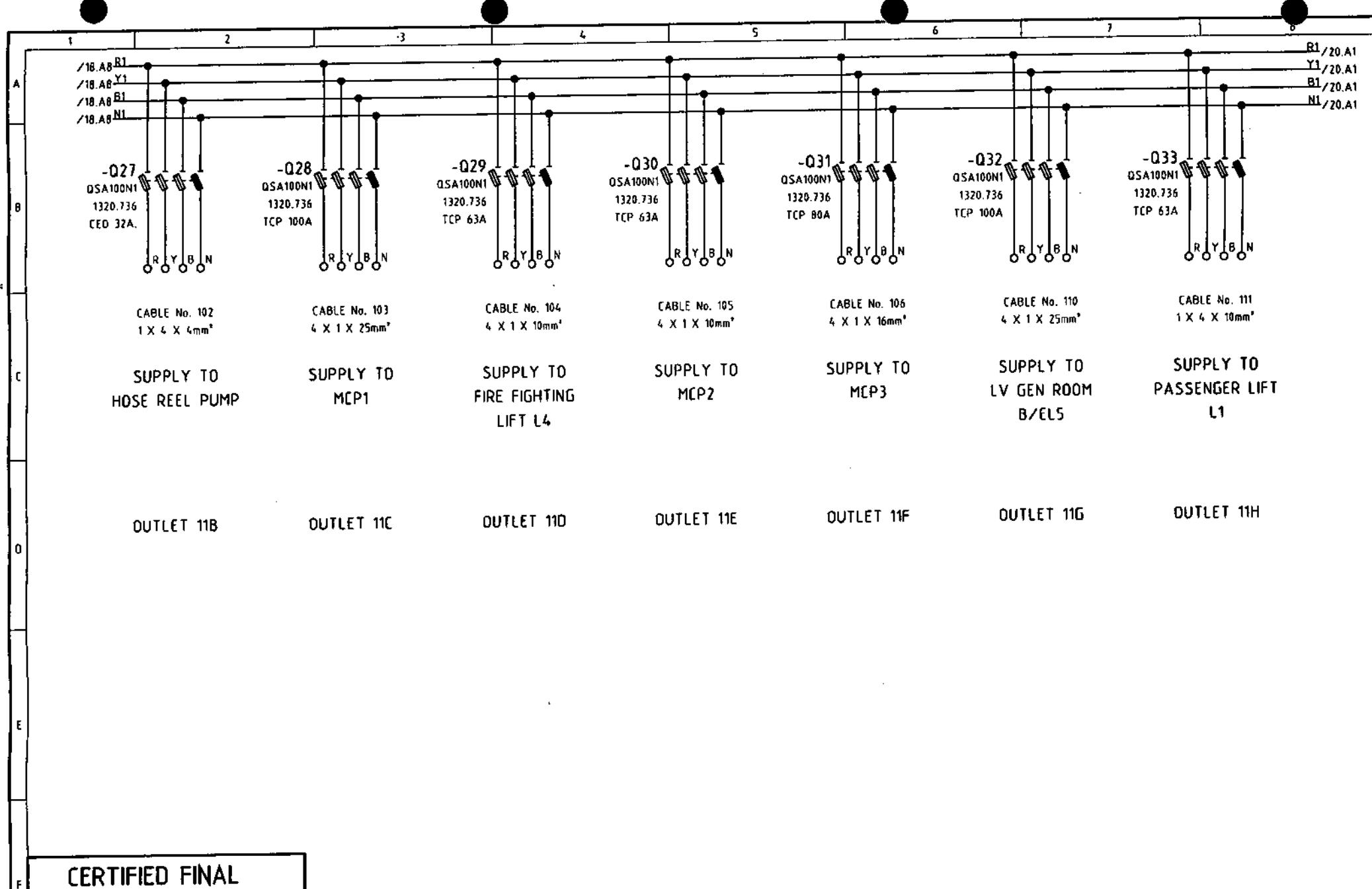
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5-7 CARLTON GARDENS
LONDON

Title
SB 01
POWER SCHEMATIC
DUT FEEDERS

Client
T. CLARKE PLC
CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/A/18

Revision B
17 of 18



CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Drawn:	J. McENVY		
Check:			
Approved:			



Project
5-7 CARLTON GARDENS
LONDON

title
SB 01
POWER SCHEMATIC
OUT FEEDERS

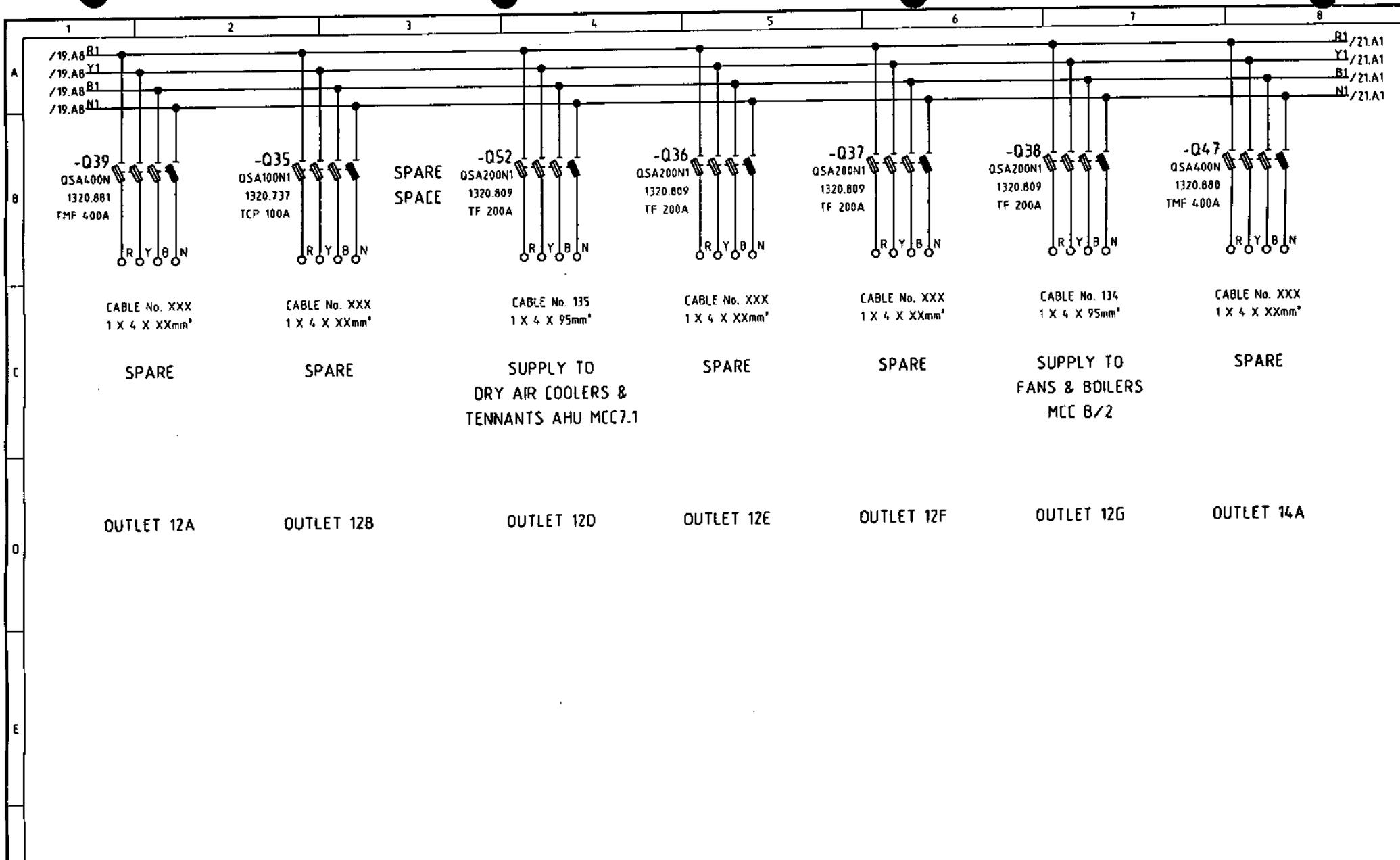
Client
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/A/1

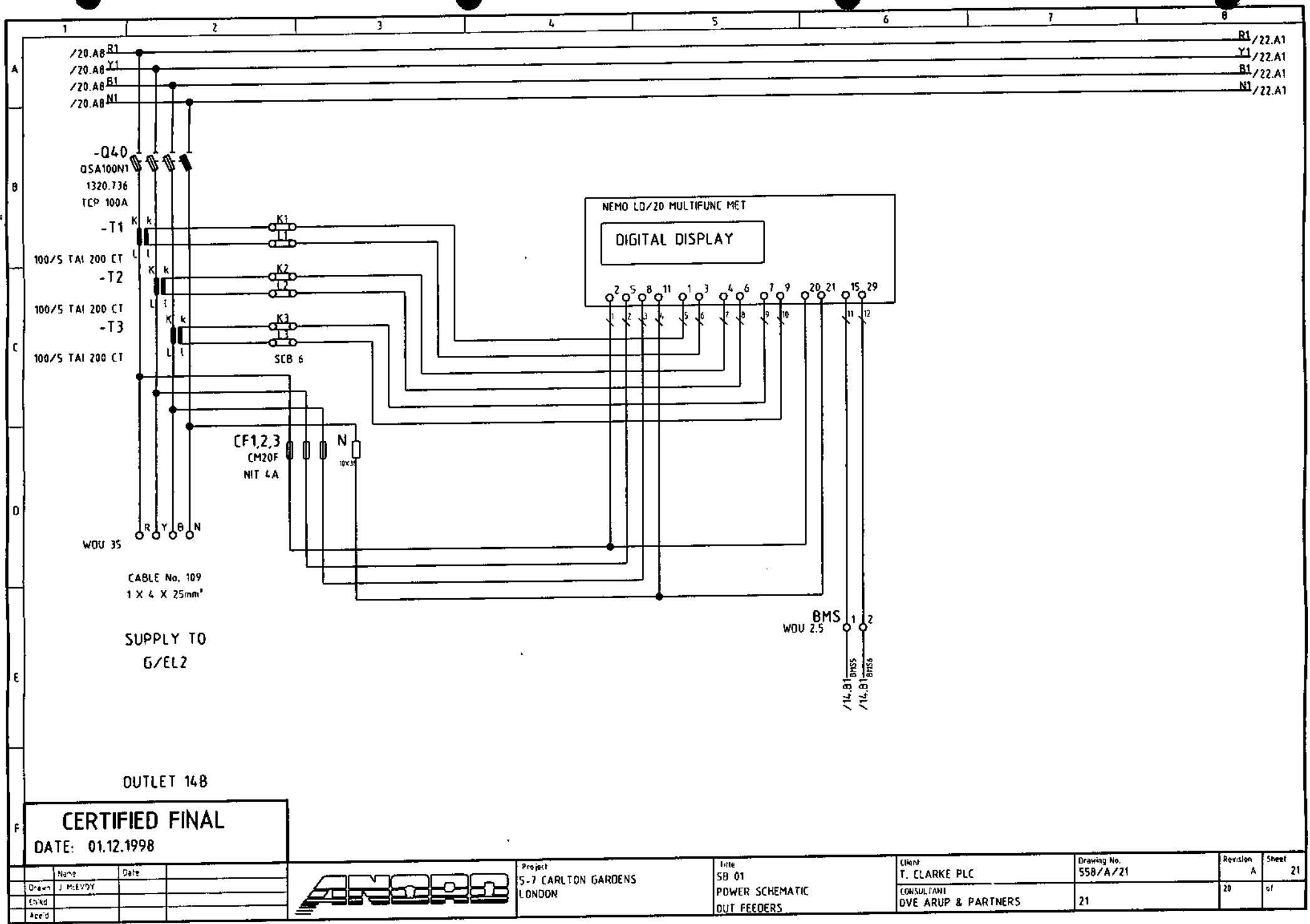
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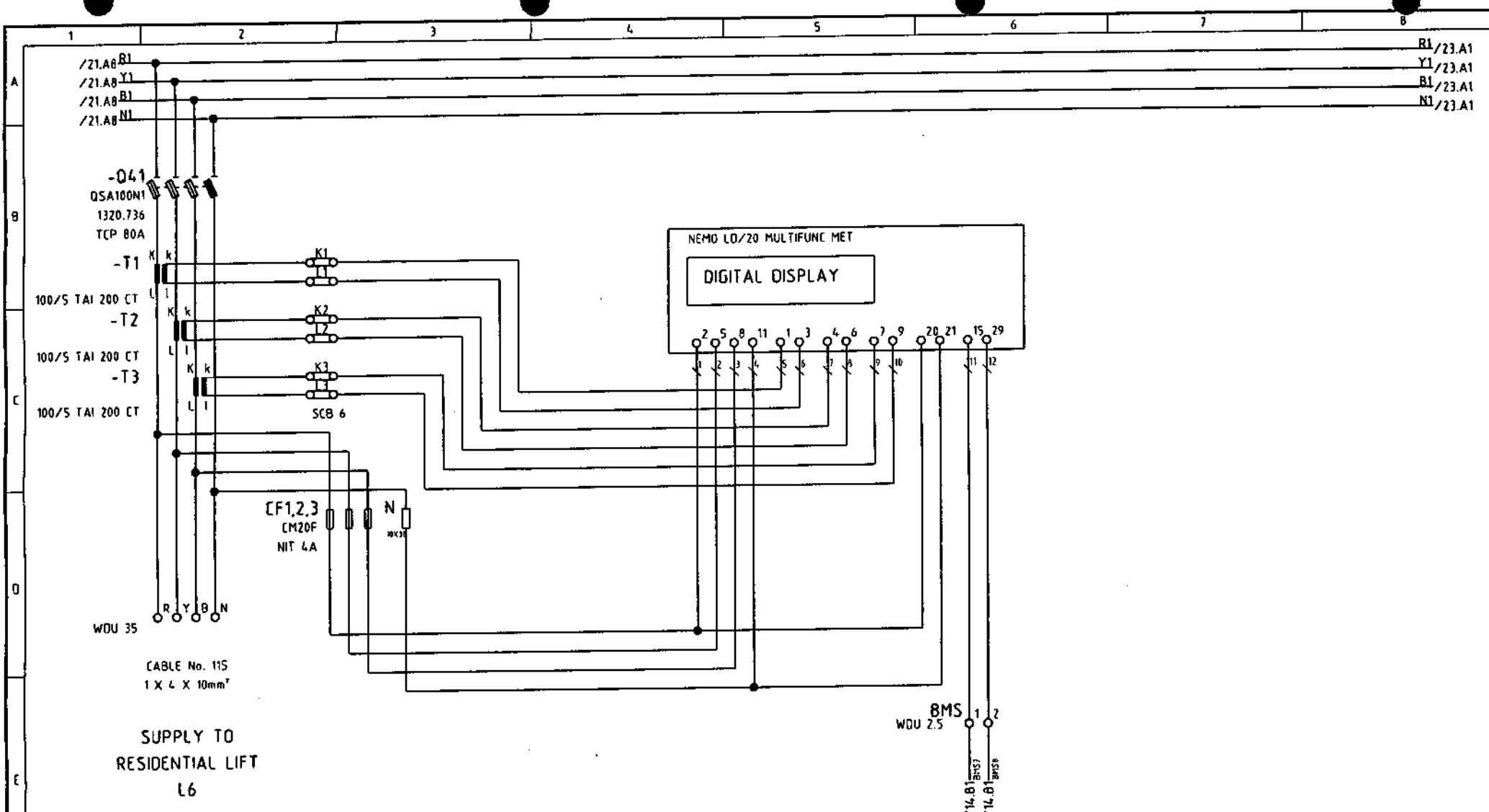
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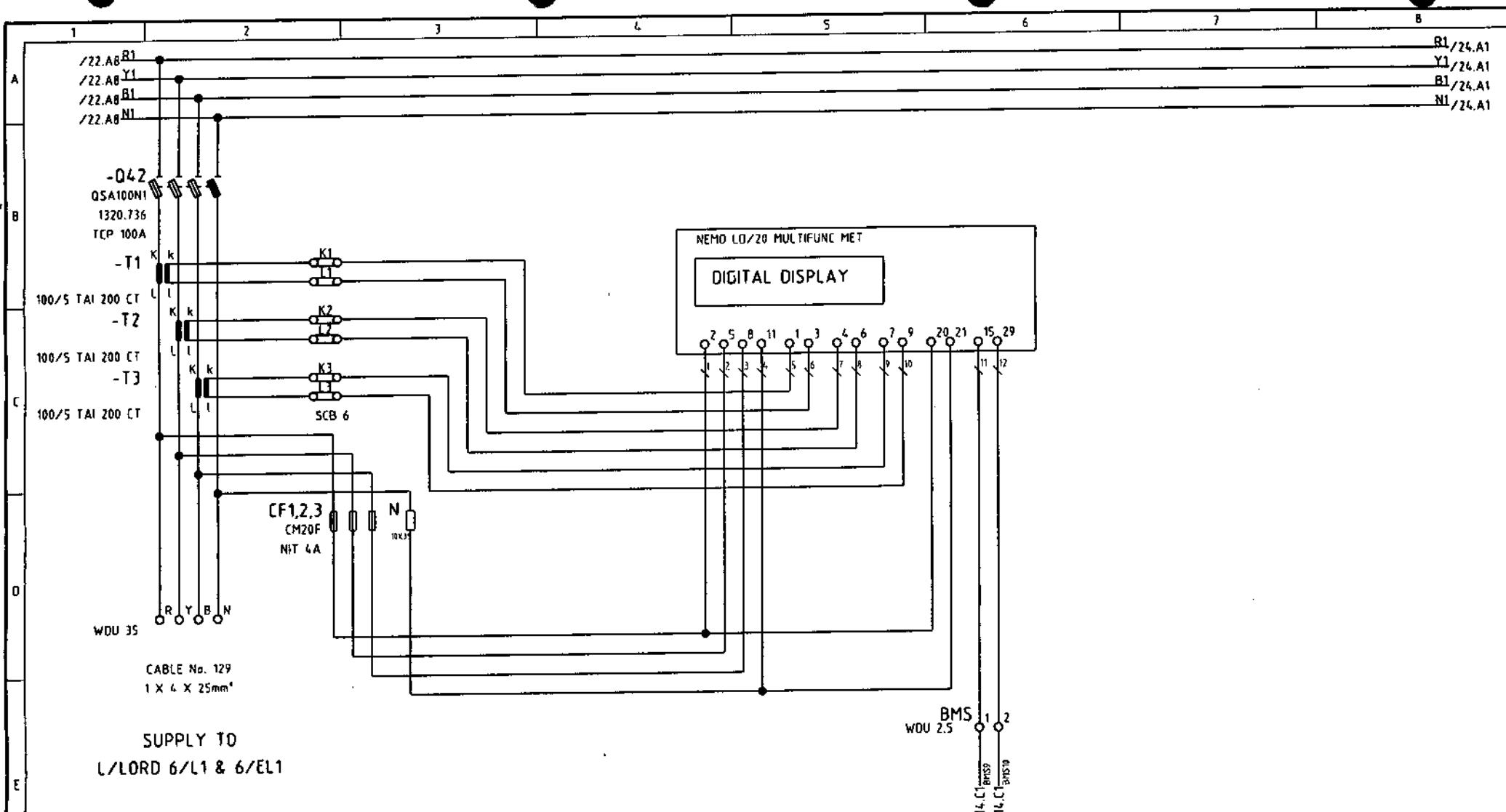
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Chkd							19	of
App'd								







Name	Date	Project	File	Client	Drawing No.	Revision	Sheet
Drawn: J. McEVoy		5-7 CARLTON GARDENS LONDON	SB 01 POWER SCHEMATIC OUT FEEDERS	T. CLARKE PLC CONSULTANT OVE ARUP & PARTNERS	558/A/22	A	22
Chkd:						Z1	of
Appd:					22		



CERTIFIED FINAL

DATE: 01.12.1998



Project
5-7 CARLTON GARDENS
LONDON

Title
SB 01
POWER SCHEMATIC
OUT FEEDERS

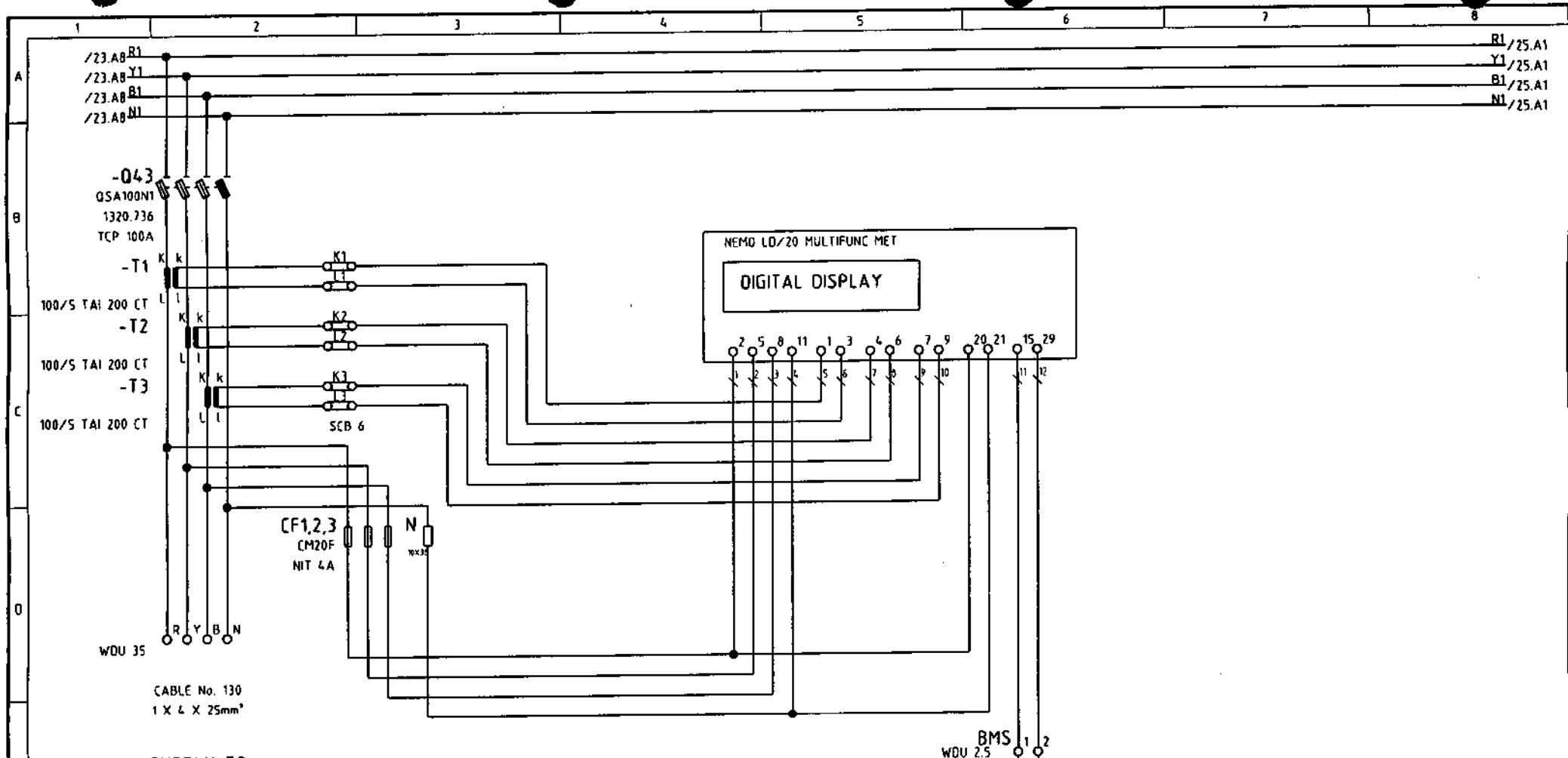
Client
T. CLARKE PLC

CONSULTANT
DOE ARUP & PARTNERS

Drawing No.
558/A/23

Revision A
22 of
Sheet 23

Name	Date	
Drawn J. McEVY		
Spk'd		
App'd		

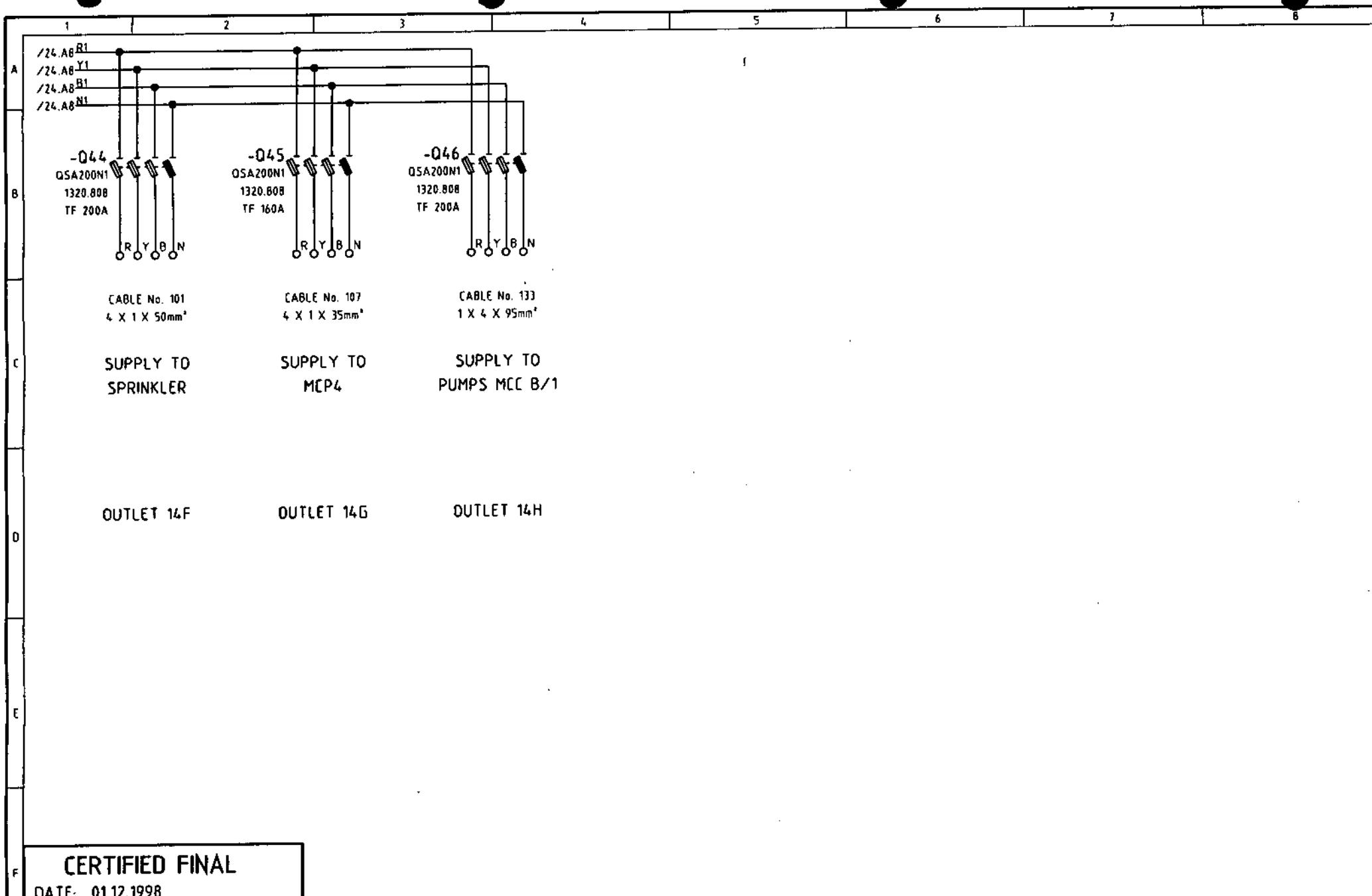


OUTLET 14E

CERTIFIED FINAL

DATE: 01.12.1998

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
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Checked						23	of
Approved							



Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn: J. McEVoy		S-7 CARLTON GARDENS LONDON	SB 01 POWER SCHEMATIC OUT FEEDERS	T. CLARKE PLC CONSULTANT OVE ARUP & PARTNERS	558/A/25 25	A	25 of
Chkd:							
App'd:							



1 2 3 4 5 6 7 8

ANORD/STROMBERG SWITCHGEAR, DEPTH 636mm

HORIZONTAL BUSBAR MDZR2000 100% NEUTRAL 50kA / 1 sec

A

B

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D

E

F

PROTECTION RATING IP31 FORM 4 TYPE S

COLOUR: GREY RAL 7032.

BOTTOM ENTRY BOTTOM EXIT

MOZR 800S

101.6X6.3

TINNEO BB

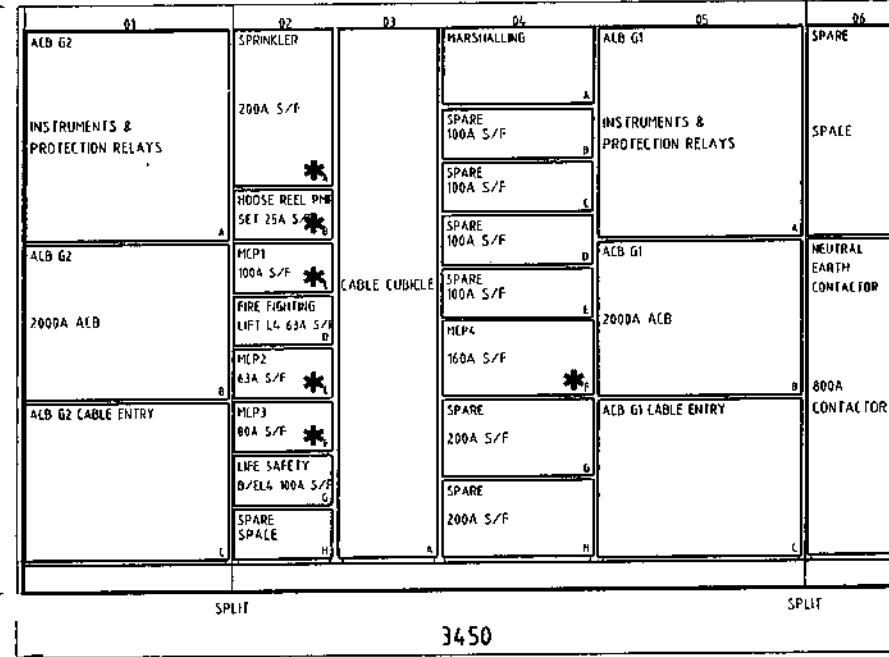
MDZR 800S

101.6X6.3

TINNEO BB

MDZR 2x100x10

MOZR 2x100x10



RED
DOOR

CONTROL CABLE COLOURS

230/110/24 VAC AUX CCTS BLACK
30VDC + BROWN 30VDC - BLUE
BMS GREY

CERTIFIED FINAL

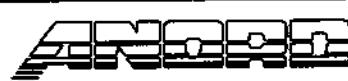
DATE: 01.12.1998

636

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BOTTOM ALUMINIUM GLAND PLATE	TOP ALUMINIUM GLAND PLATE	TOP ALUMINIUM GLAND PLATE	TOP ALUMINIUM GLAND PLATE	BOTTOM ALUMINIUM GLAND PLATE	TOP ALUMINIUM GLAND PLATE

CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

Name	Date	
Drawn J. McEvoy	12-05-98	
Chkd		
Acqd		



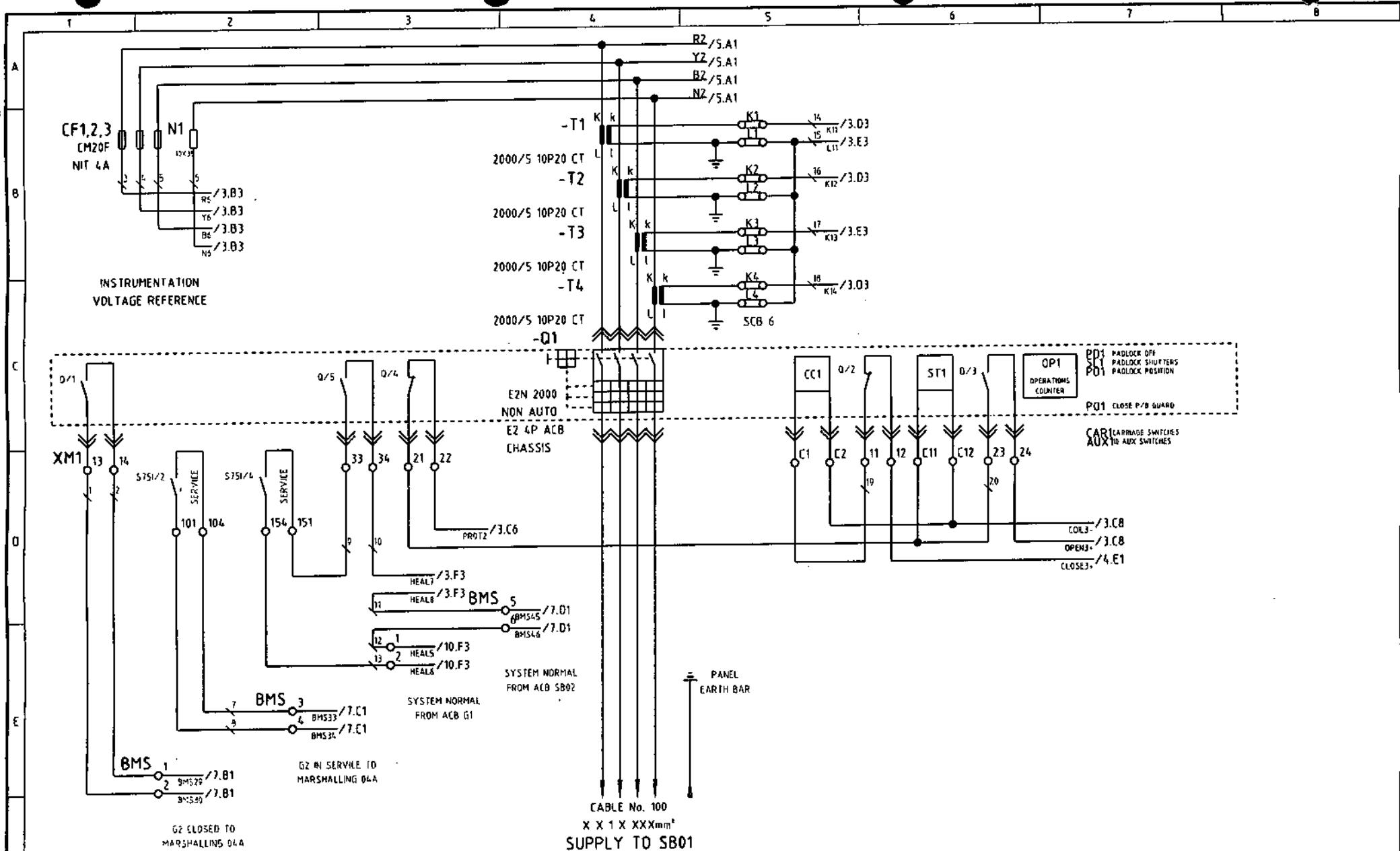
Project
5-7 CARLTON GARDENS
LONDON

Title
SB 02
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
Consultant
OVE ARUP & PARTNERS

Drawing No.
558/B/1

Revision B
Sheet 1
of



CERTIFIED FINAL

DATE: 01.12.1998



Project
S-7 CARLTON GARDENS
LONDON

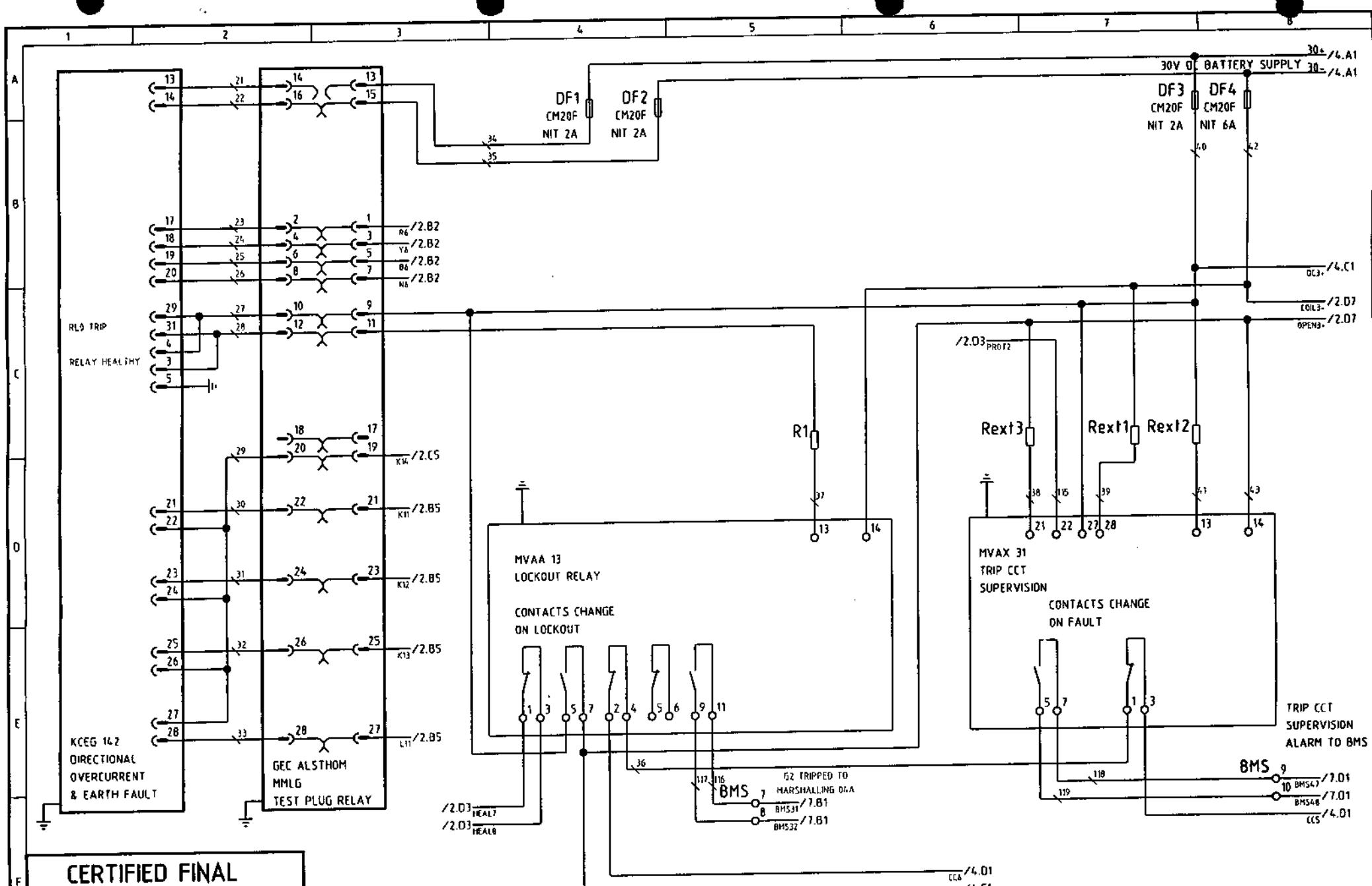
Title
SB 02
POWER SCHEMATIC
COUPLER ACB G2

Client
T. CLARKE PLC
CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/B/2

Revision A
1 of 2

Name	Date
Drawn J. McEvoy	12-03-98
Chkd	
App'd	



CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Drawn	J. McEVETY	12-01-28	
Chkd			
Acc'd			



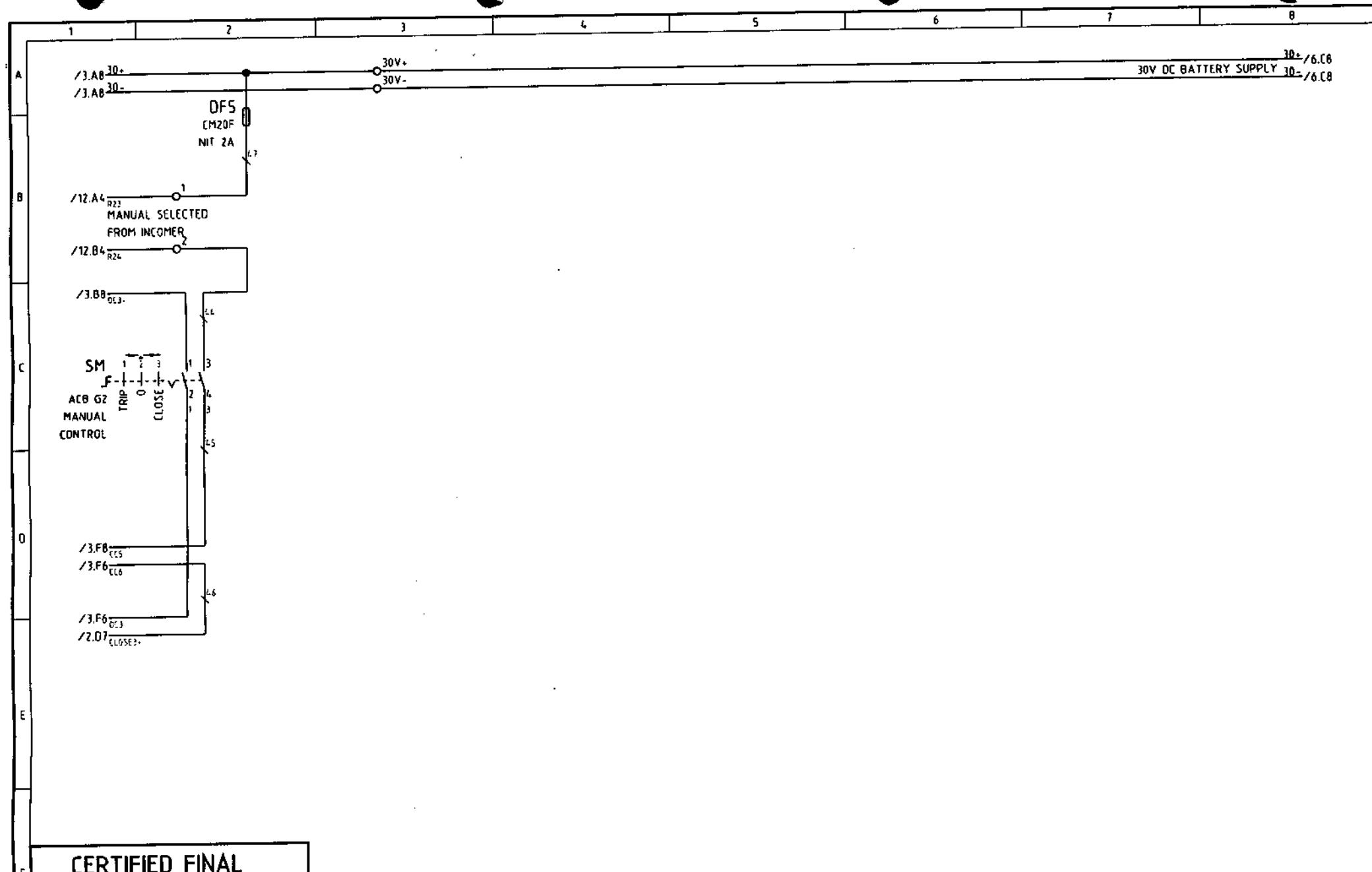
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-7 CARLTON GARDENS
LONDON

Title
SB 02
POWER SCHEMATIC
ACB G2 PROTECTION RELAYS

Client
T. CLARKE PLC
CONSULTANT
DOVE ARUP & PARTNER

Drawing No.
558/8/3

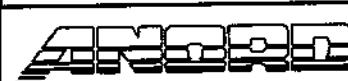
Revision A Sheet 3

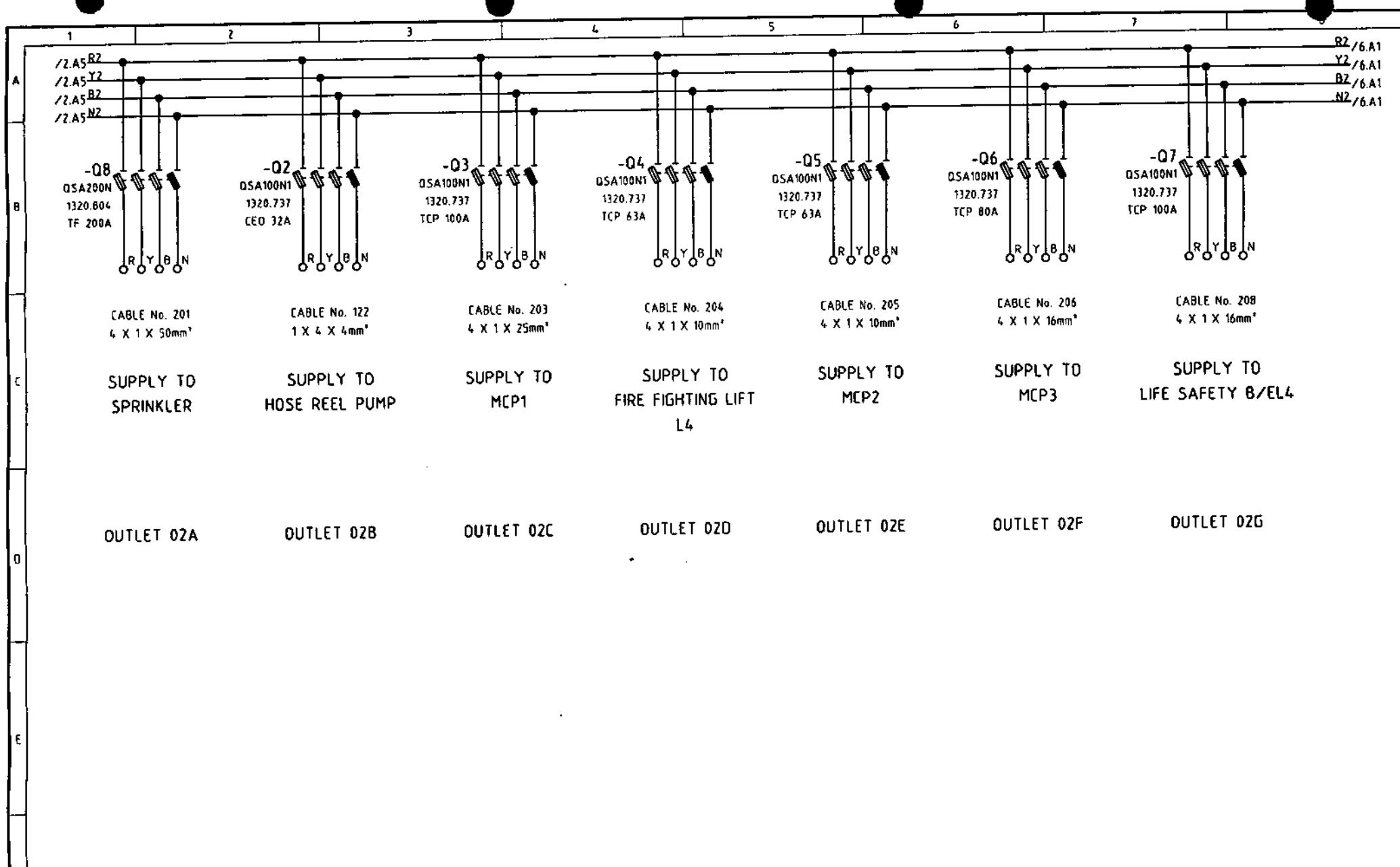


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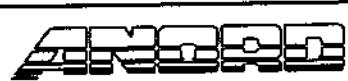
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Chkd								
App'd								





Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEVoy	12-05-98	5-7 CARLTON GARDENS LONDON	SB 02 POWER SCHEMATIC OUT FEEDERS	T. CLARKE PLC CONSULTANT DVE ARUP & PARTNERS	558/B/5	B	5
Chkd						4	of
App'd						5	



	1	2	3	4	5	6	7	8
A	/S.A8 ^{B2}							R2 /B.A1
	/S.A8 ^{Y2}							Y2 /B.A1
	/S.A8 ^{B2}							B2 /B.A1
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	/S.A8							

SPARE
SPACE

B

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E

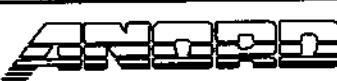
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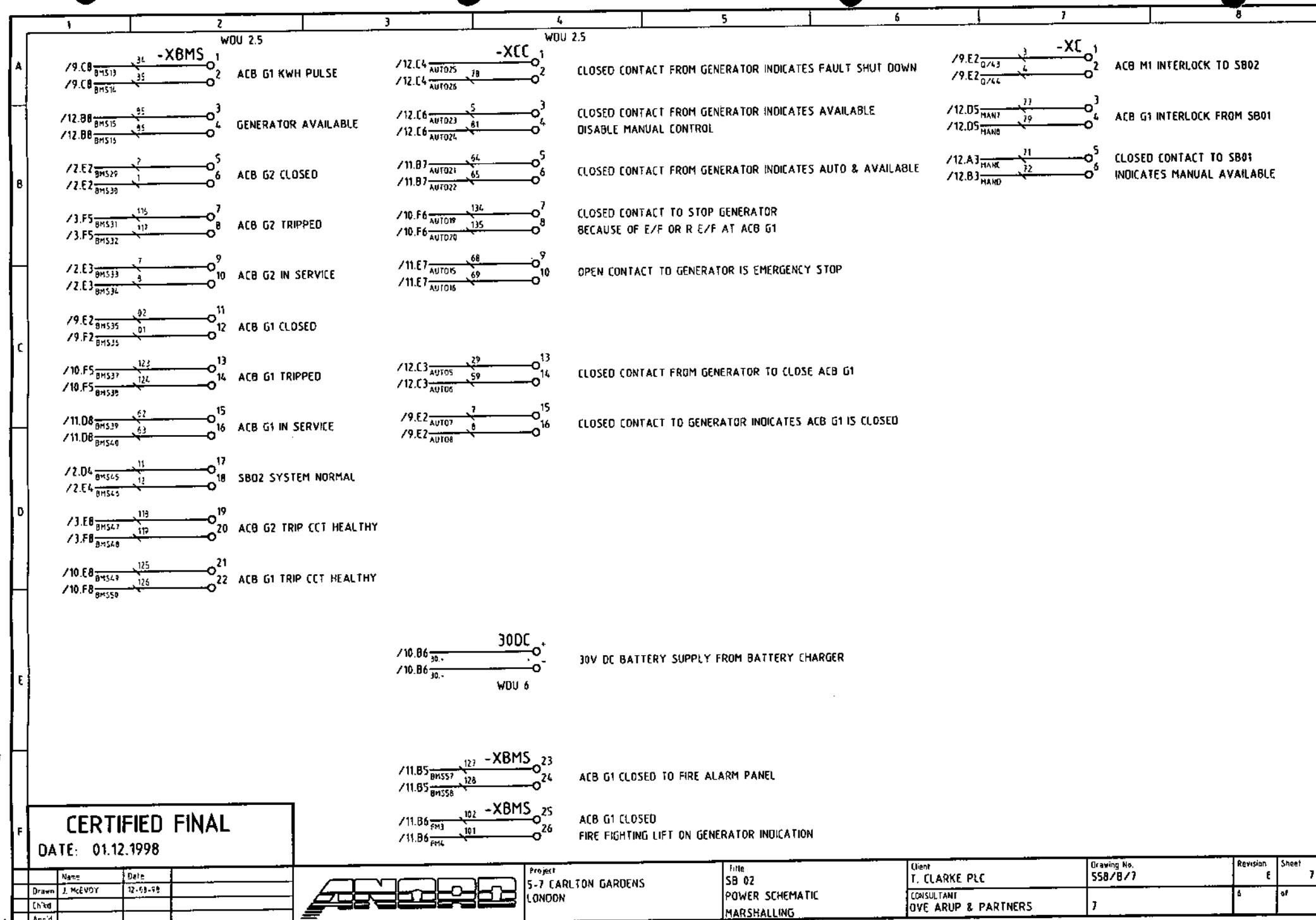
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CERTIFIED FINAL

DATE: 01.12.1998

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CERTIFIED FINAL

DATE: 01.12.1998

	Name	Date	
Drawn	J. McEVODY	12-63-98	
Chkd			
Agnd			



**Project
6-7 CARLTON GARDENS
ONOND**

**File
SB 02
POWER SCHEMATI
MARSHALLING**

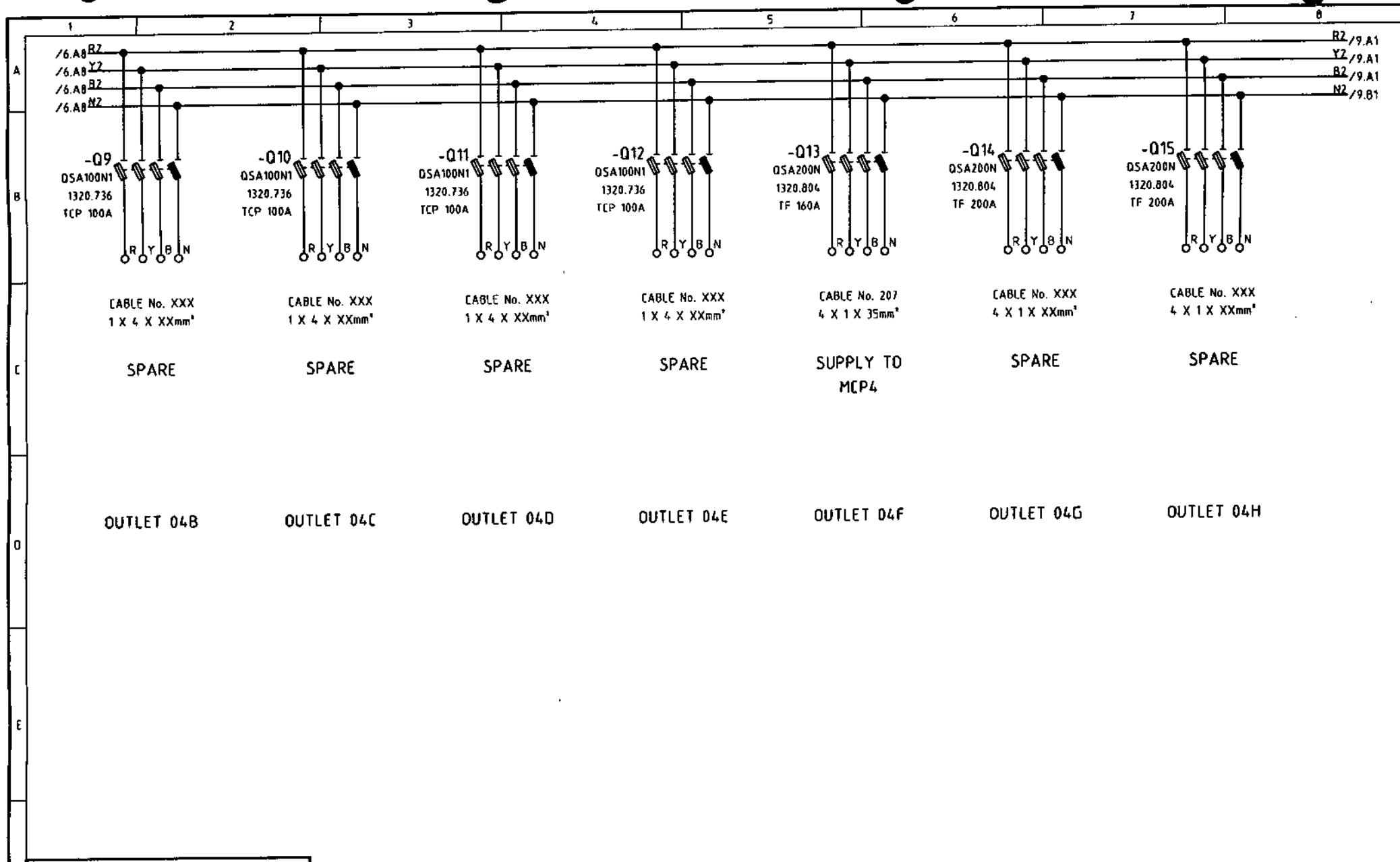
T. CLARKE P.
CONSULTANT

Drawing No.
558/B

1

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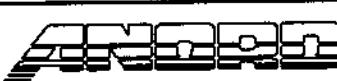
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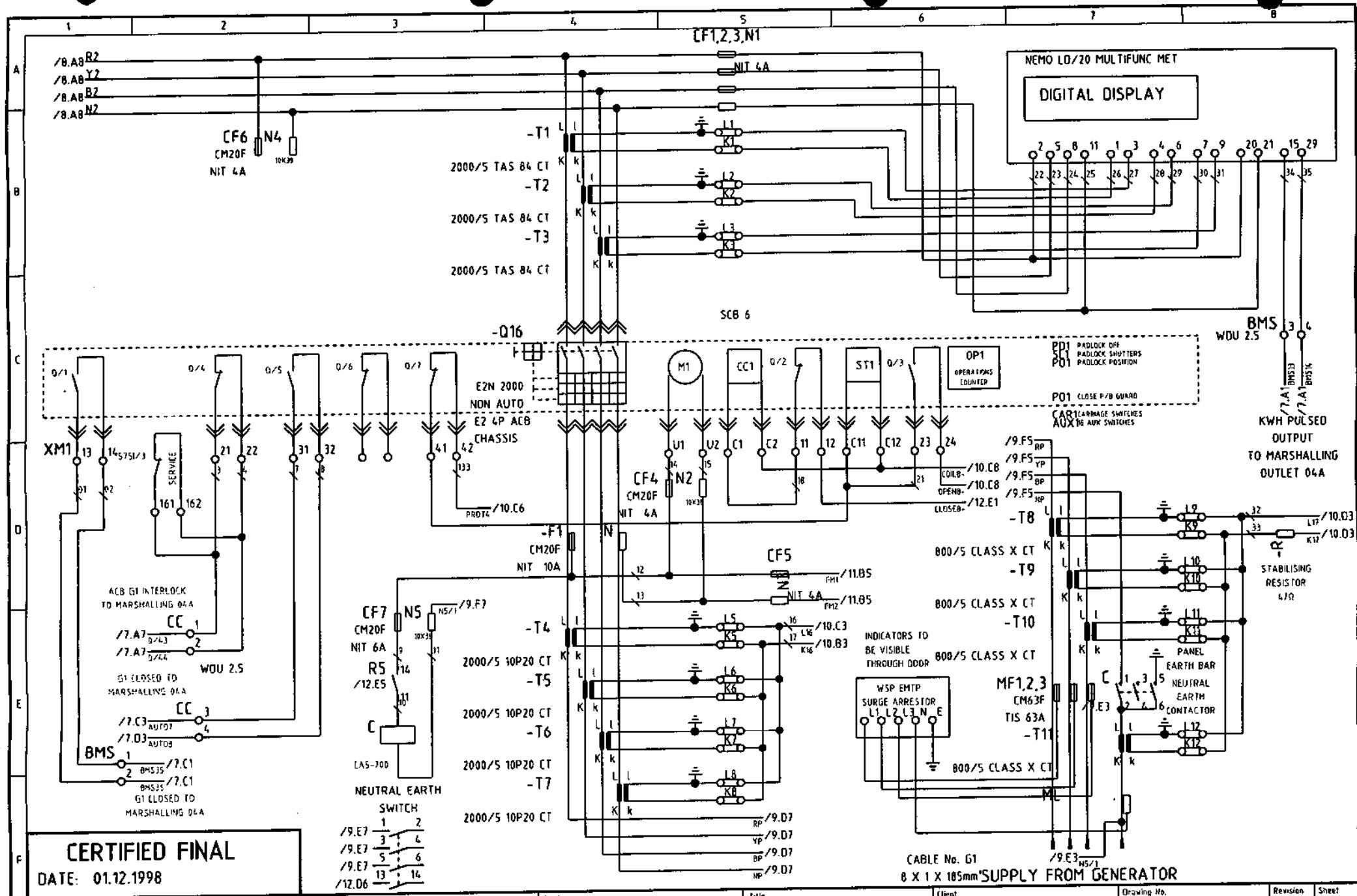


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DATE: 01.12.1998

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
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Chkd						7	of
App'd							





CERTIFIED FINAL

DATE: 01.12.1998

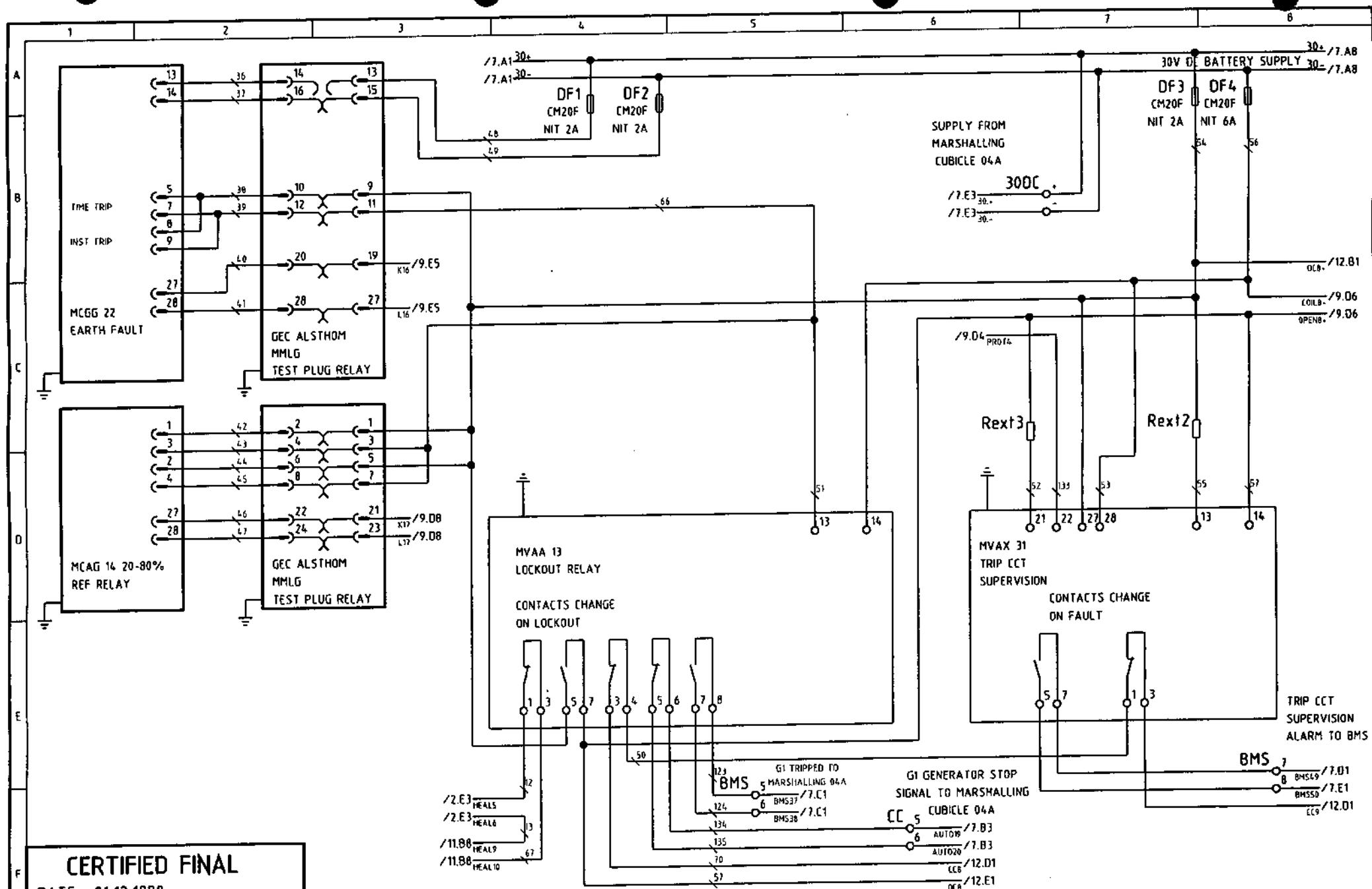
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Drawn	J. McEVoy	12-05-98	
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Enkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

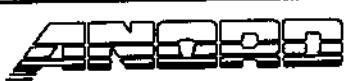
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SB 02
POWER SCHEMAT
ACB G1

Client T. CLARKE PLC	Drawing No. SSB/B/9	Revision D	Sheet 9
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CERTIFIED FINAL

DATE: 01.12.1998



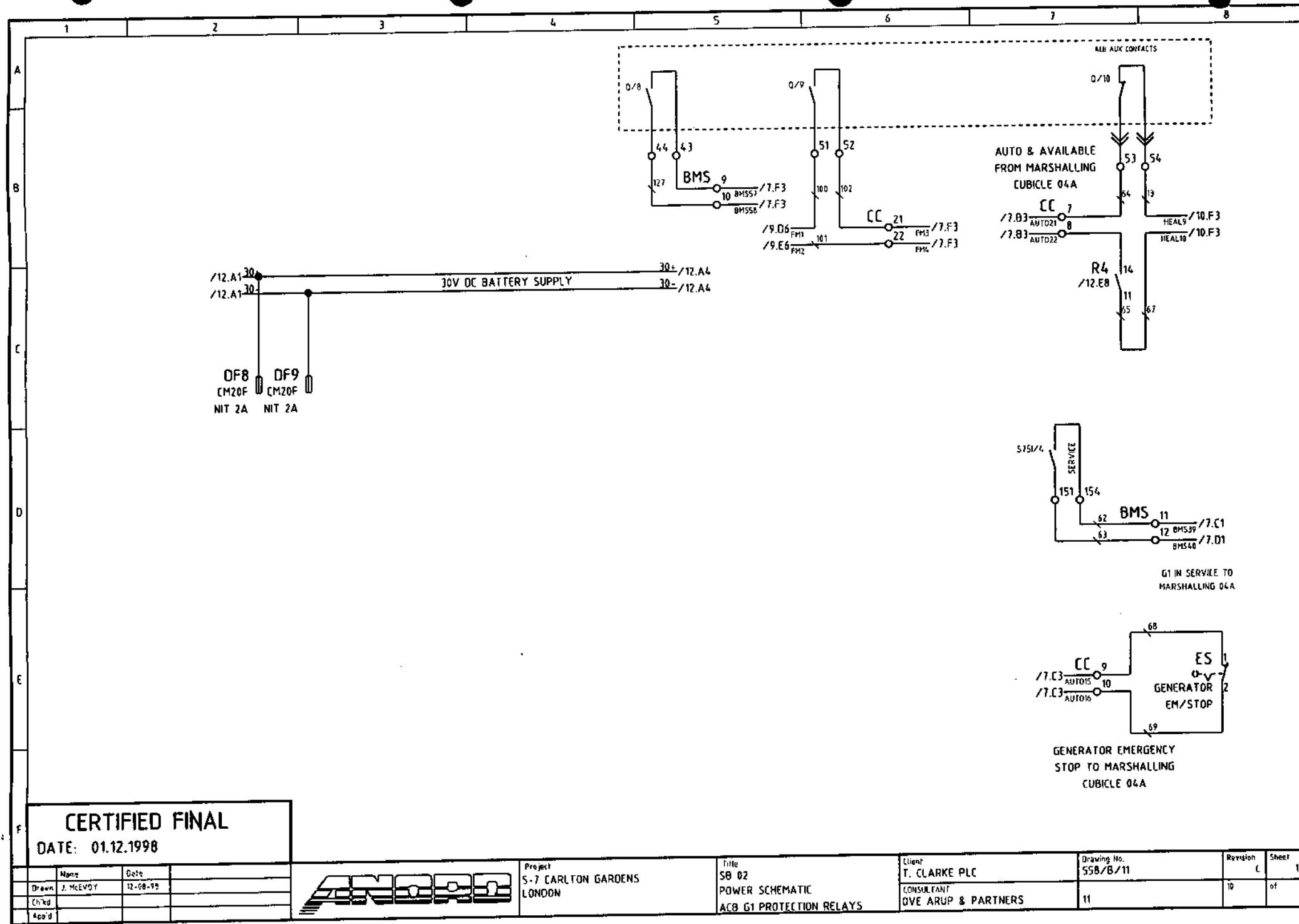
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5-7 CARLTON GARDENS
LONDON

Title
SB 02
POWER SCHEMATIC
ACB G1 PROTECTION RELAYS

Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS

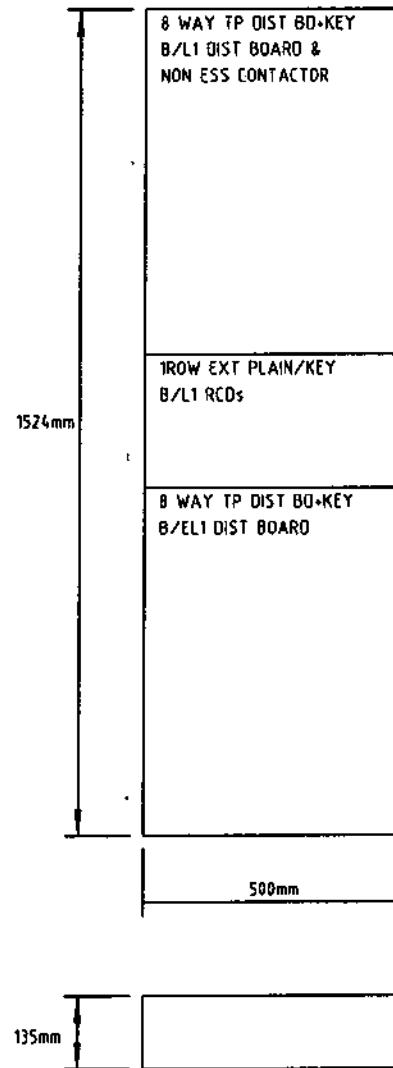
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558/B/10
Revision B
Sheet 10
of

Drawn	Name	Date	
J. McEVoy		12-05-98	
(Ink)			
Approved			



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998 *A.1*

	Name	Date	
Drawn	J. McEVoy	05-08-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD B/L1 & B/EL1
GENERAL ARRANGEMENT

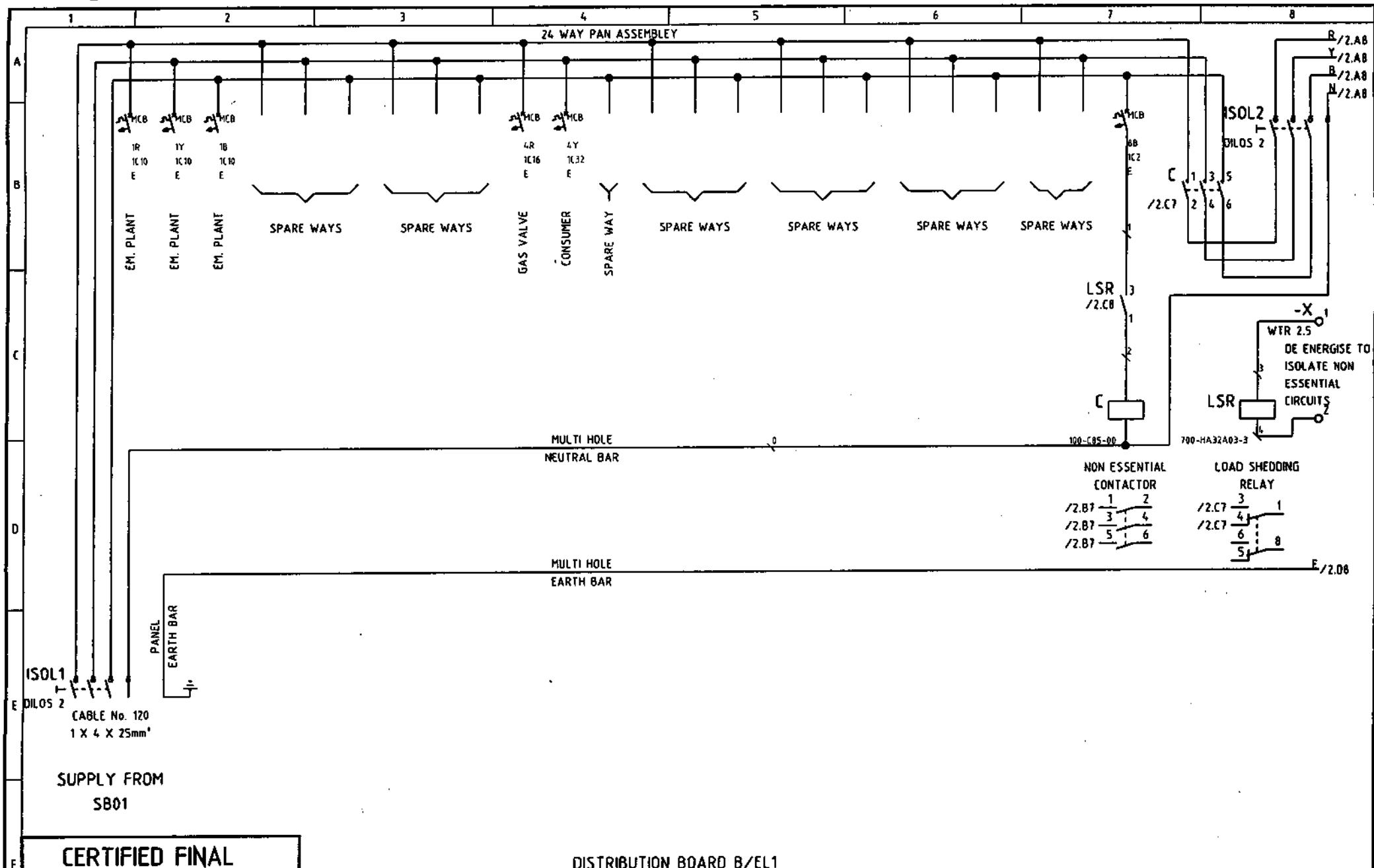
Client
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

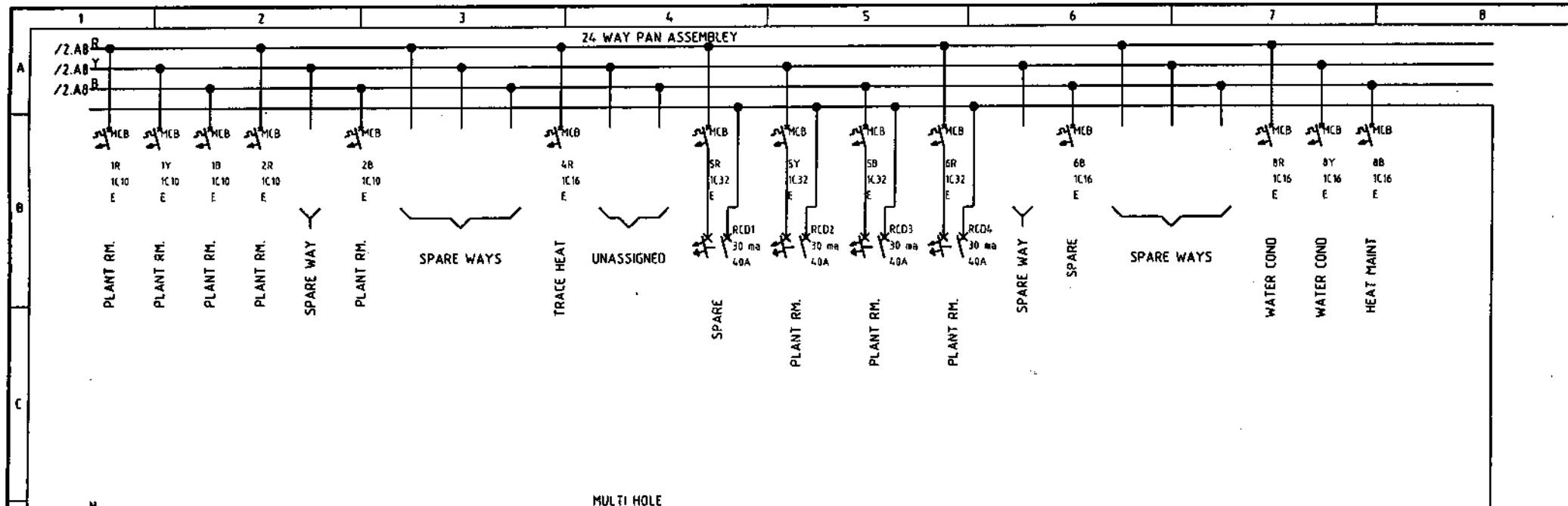
Drawing No.
558/C1/1

Revision
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Sheet
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of



Name	Date	Drawn	Chkd	App'd	Project	Title	Client	Drawing No.	Revision	Sheet
J. McEVoy	05-08-98				5-7 CARLTON GARDENS LONDON	L/LORD B/L1 & B/EL1 B/EL1 POWER SCHEMATIC	T. CLARKE PLC	558/C1/2		2
							CONSULTANT		1	of
							DOE ARUP & PARTNERS	2		



CERTIFIED FINAL

DATE: 21.10.1998

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DISTRIBUTION BOARD B/L1



Name	Date
Draughn J McEVADY	05-08-98
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Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD B/L1 & B/EL1
B/L1 POWER SCHEMATIC

Client
T. CLARKE PLC

**CONSULTANT
DOVE ARUP & PARTNERS**

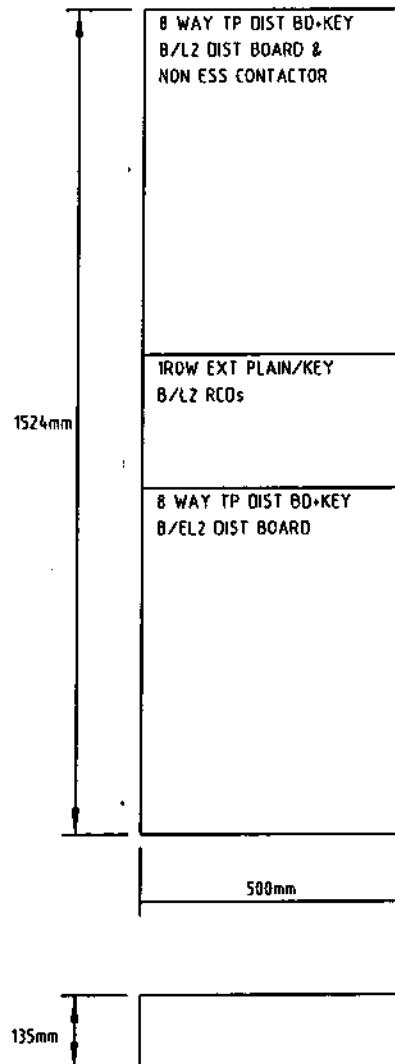
Drawing No.
SSB/C1/3

Revision Sheet

3

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998 *A.1*

	Name	Date
Drawn	J. McEVoy	05-08-98
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

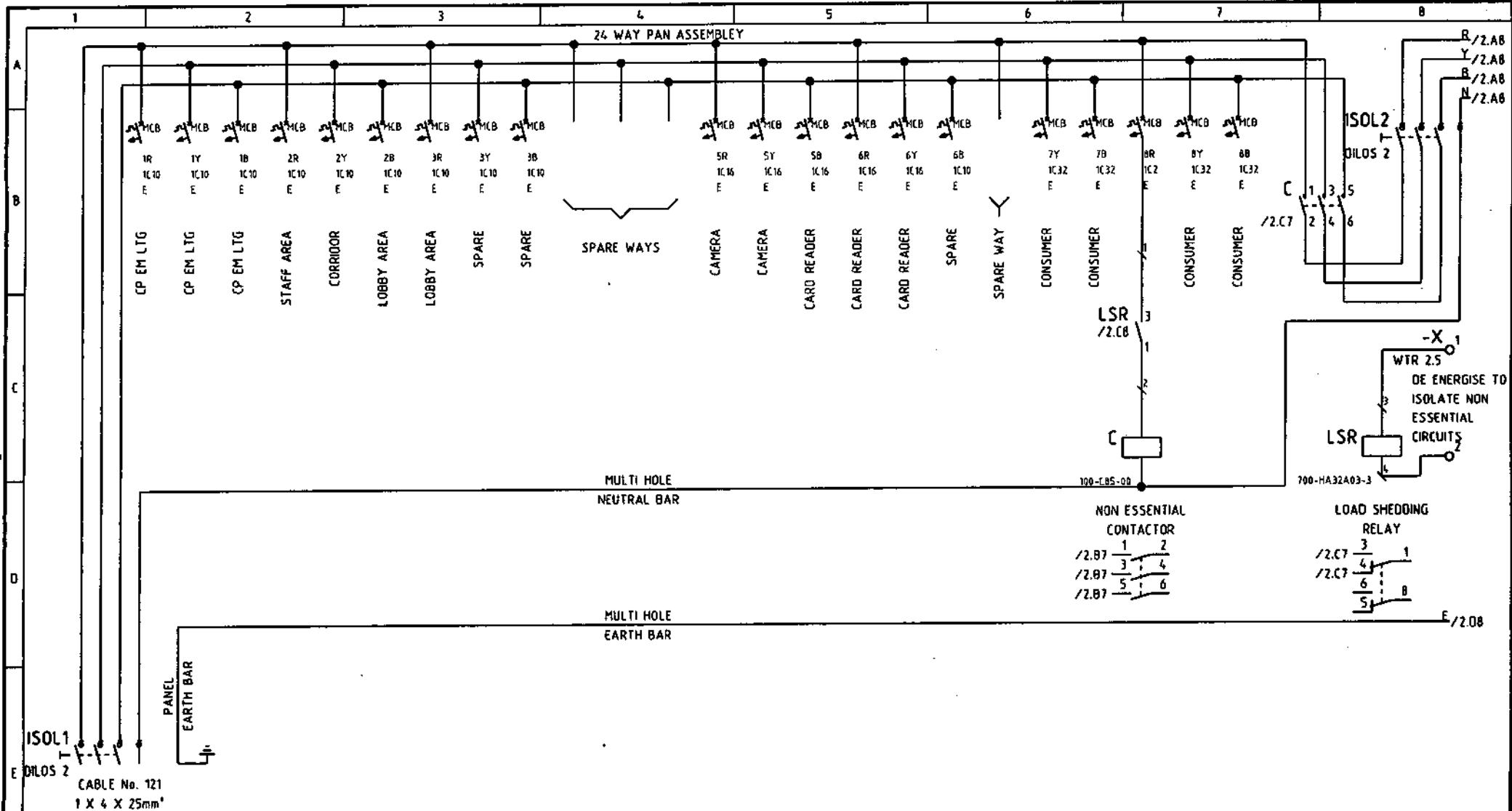
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L/LORD B/L2 & B/EL2
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
DVE ARUP & PARTNERS

Drawing No.
558/C2/1

Revision
Sheet 1
of



SUPPLY FROM
SB01

CERTIFIED FINAL	
DATE: 21.10.1998 <i>A-T</i>	

DISTRIBUTION BOARD B/EL2



Project:
S-7 CARLTON GARDENS
LONDON

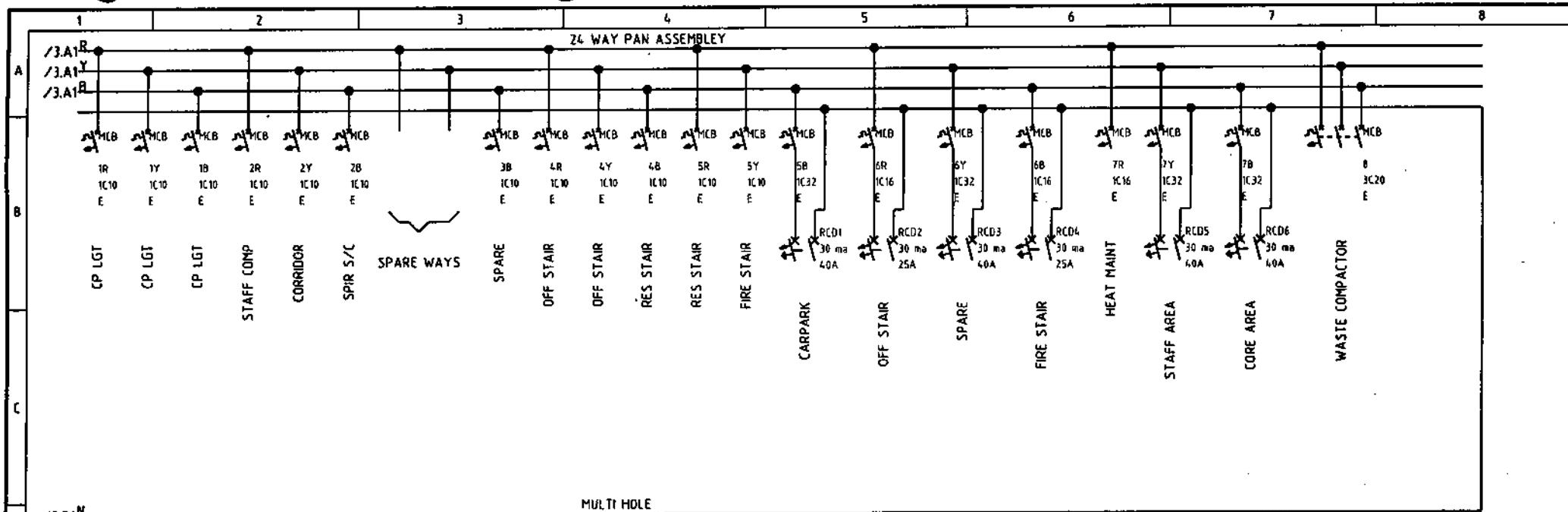
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L/LORD B/L2 & B/EL2
B/EL2 POWER SCHEMATIC

Client:
T. CLARKE PLC
CONSULTANT:
DVE ARUP & PARTNERS

Drawing No.
558/C2/2
2

Revision
Sheet
2
of

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



/3.01N

MULTI HOLE
NEUTRAL BAR

/3.01E

MULTI HOLE
EARTH BAR

CERTIFIED FINAL
DATE: 21.10.1998 *A-7*

Name	Date
Drawn J. McEVY	05-08-98
Chkd	
App'd	

DISTRIBUTION BOARD B/L2



Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD B/L2 & B/EL2
B/L2 POWER SCHEMATIC

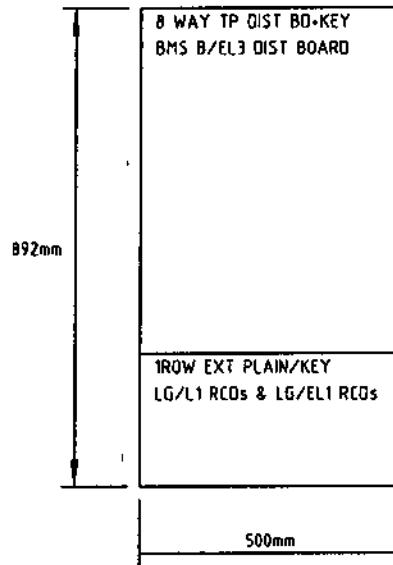
Client
T. CLARKE PLC
CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/C2/3

Revision
2
of
3

1 2 3 4 5 6 7 8

A
GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



F
CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

G
CERTIFIED FINAL
DATE: 21.10.1998 *A.T.*

135mm

	Name	Date
Drawn	J. McEVoy	05-08-98
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD BMS B/EL3
GENERAL ARRANGEMENT

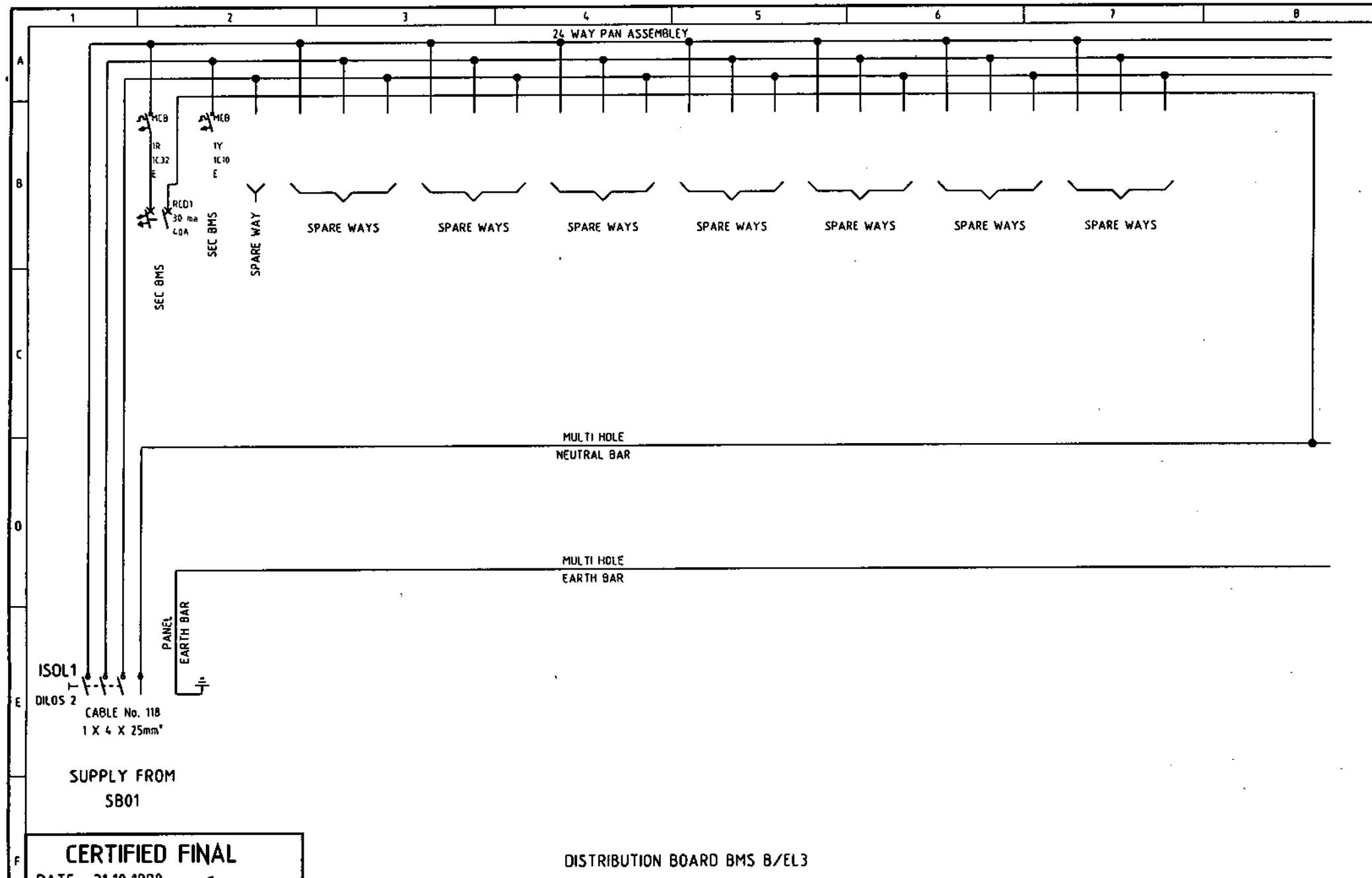
Client
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
SSB/C3/1

Revision
1

Sheet
1
of



CERTIFIED FINAL

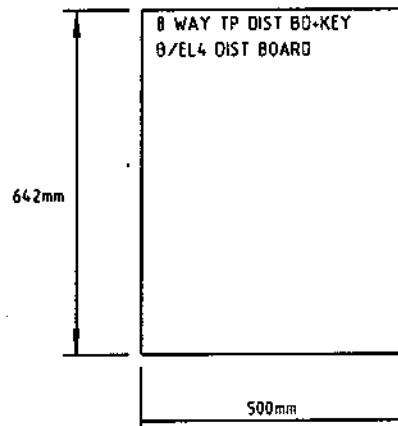
DATE: 21.10.1998

DISTRIBUTION BOARD BMS B/EL3

DATE: 21.10.1996			A/T												
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Drawn	J. McEVoy	05-09-96				5-7 CARLTON GARDENS LONDON		L/LORD BMS B/EL3 B/EL3 POWER SCHEMATIC		T. CLARKE PLC		558/C3/2			2
Checked										CONSULTANT OVE ARUP & PARTNERS		2		1	of
Approved															
															

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F
GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK



CERTIFIED FINAL
DATE: 21.10.1998 A.T.

	Name	Date	
Drawn	J. McEVoy	05-08-98	
Check			
App'd			



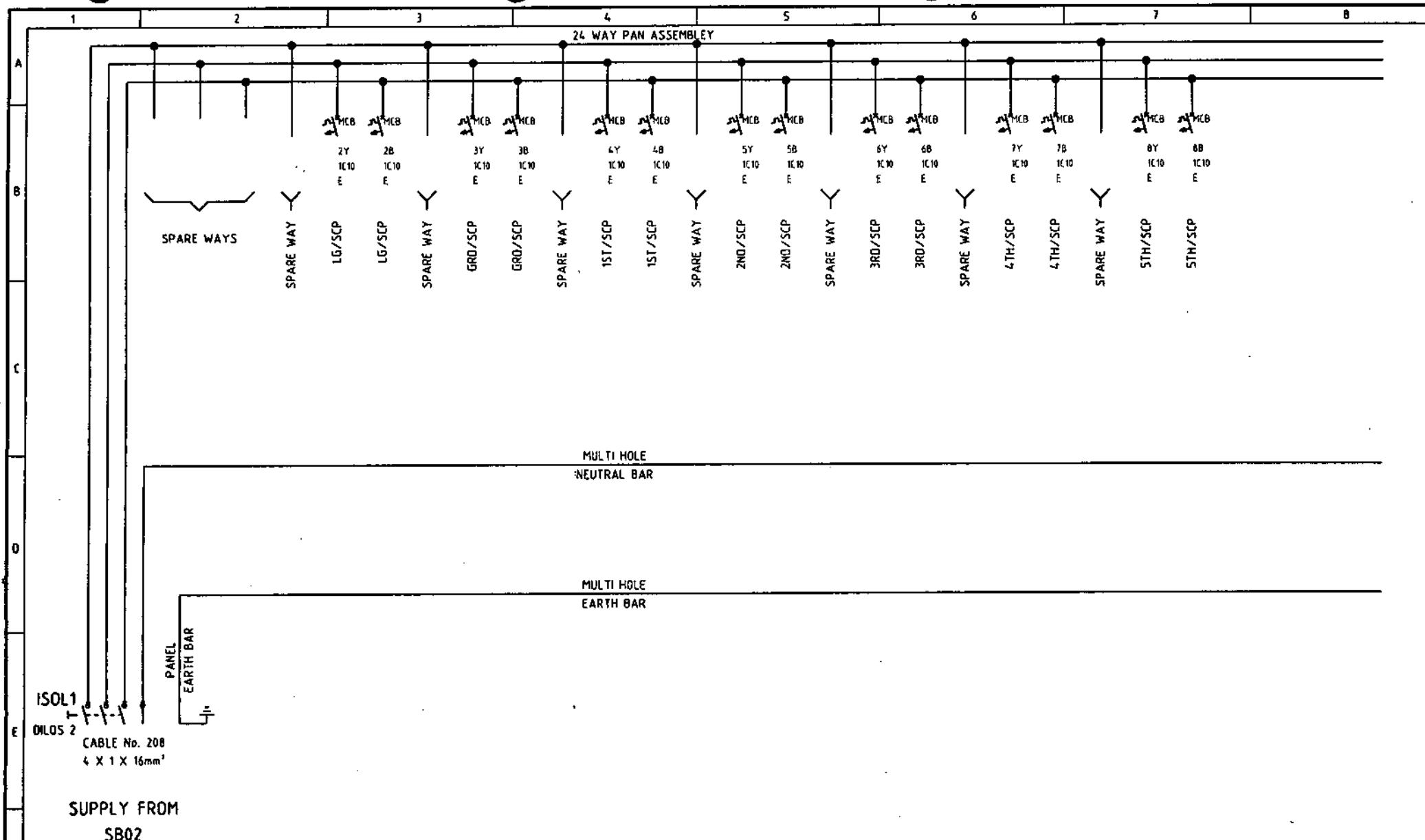
Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD B/EL4
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
DOE ARUP & PARTNERS

Drawing No.
55B/C4/1
1

Revision
Sheet
1
of



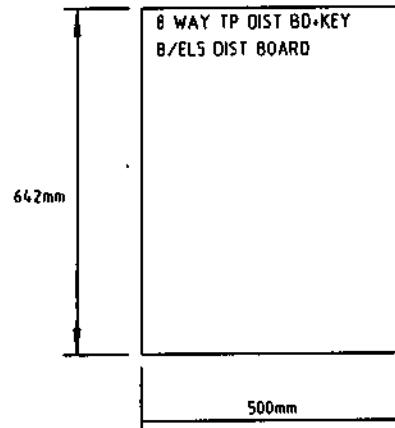
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DATE: 21.10.1998

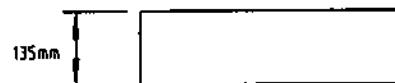
DISTRIBUTION BOARD B/EL4

1 2 3 4 5 6 7 8

GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK



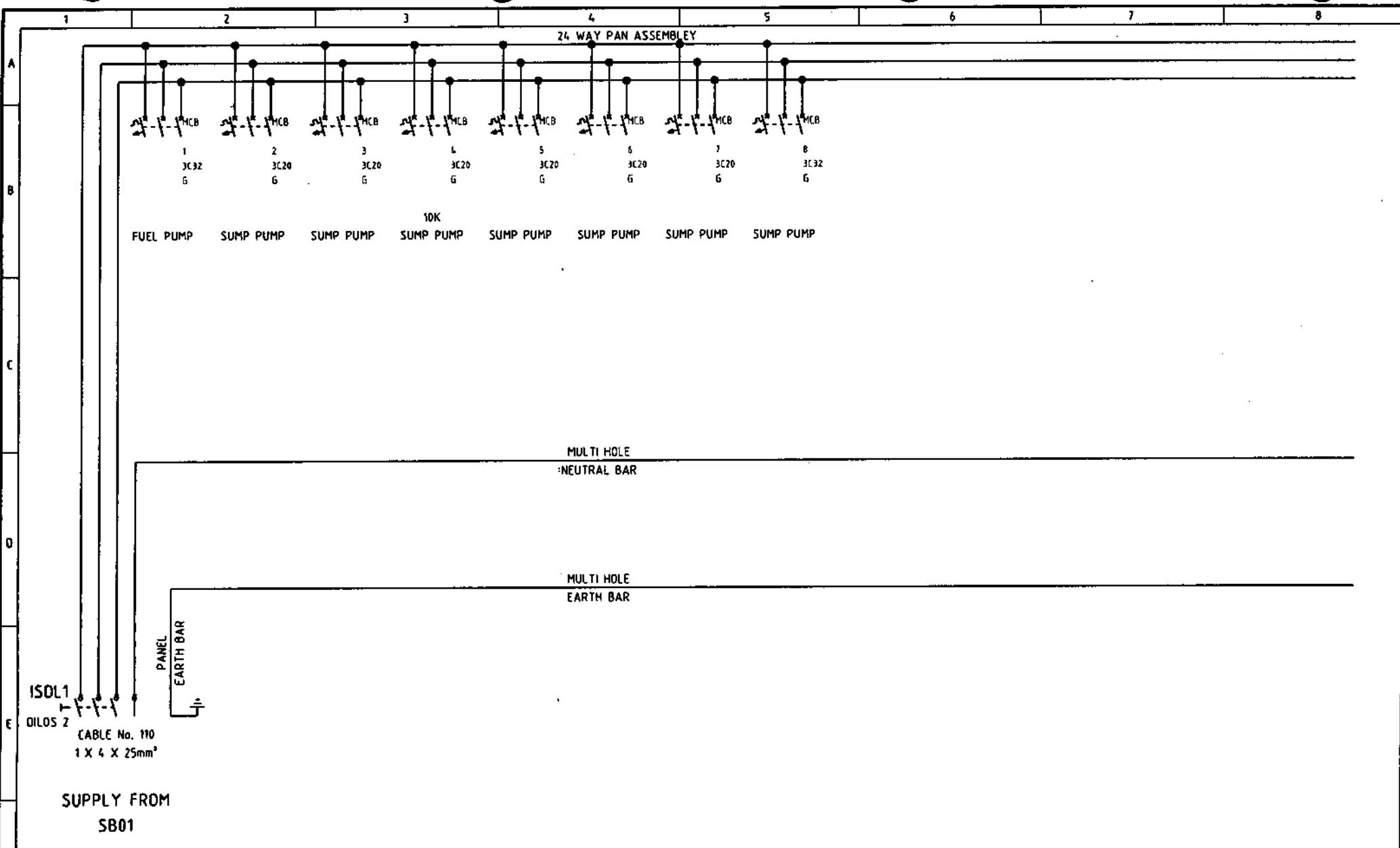
CERTIFIED FINAL

DATE: 21.10.1998

A.T

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Drawn J. McEVoy	05-08-98			5-7 CARLTON GARDENS LONDON	L/LORD B/ELS GENERAL ARRANGEMENT	T. CLARKE PLC CONSULTANT OVE ARUP & PARTNERS	558/C5/1		1
									of





CERTIFIED FINAL

DATE: 21.10.1998

DISTRIBUTION BOARD B/ELS

	Name	Date					
Drawn	J. McEVoy	05-08-98					
Chkd							
App'd							

Project: 5-7 CARLTON GARDENS LONDON

Title: T/LORD B/ELS
B/ELS POWER SCHEMATIC

Client: T. CLARKE PLC

Consultant: OVE ARUP & PARTNERS

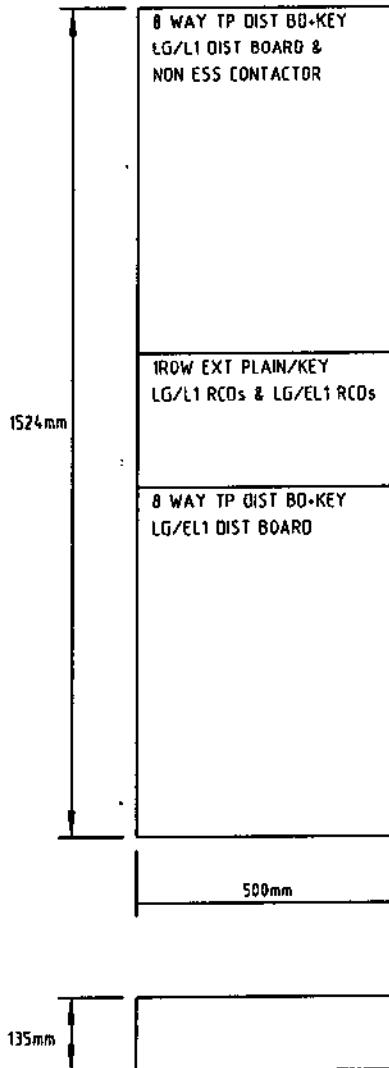
Drawing No.: 558/CS/2

Revision: 1

Sheet: 2 of

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998

A7

	Name	Date	
Drawn	J. McEVoy	05-08-98	
Chkd			
App'd			



Project:
5-7 CARLTON GARDENS
LONDON

Title:
L/LORD LG/L1 & LG/EL1
GENERAL ARRANGEMENT

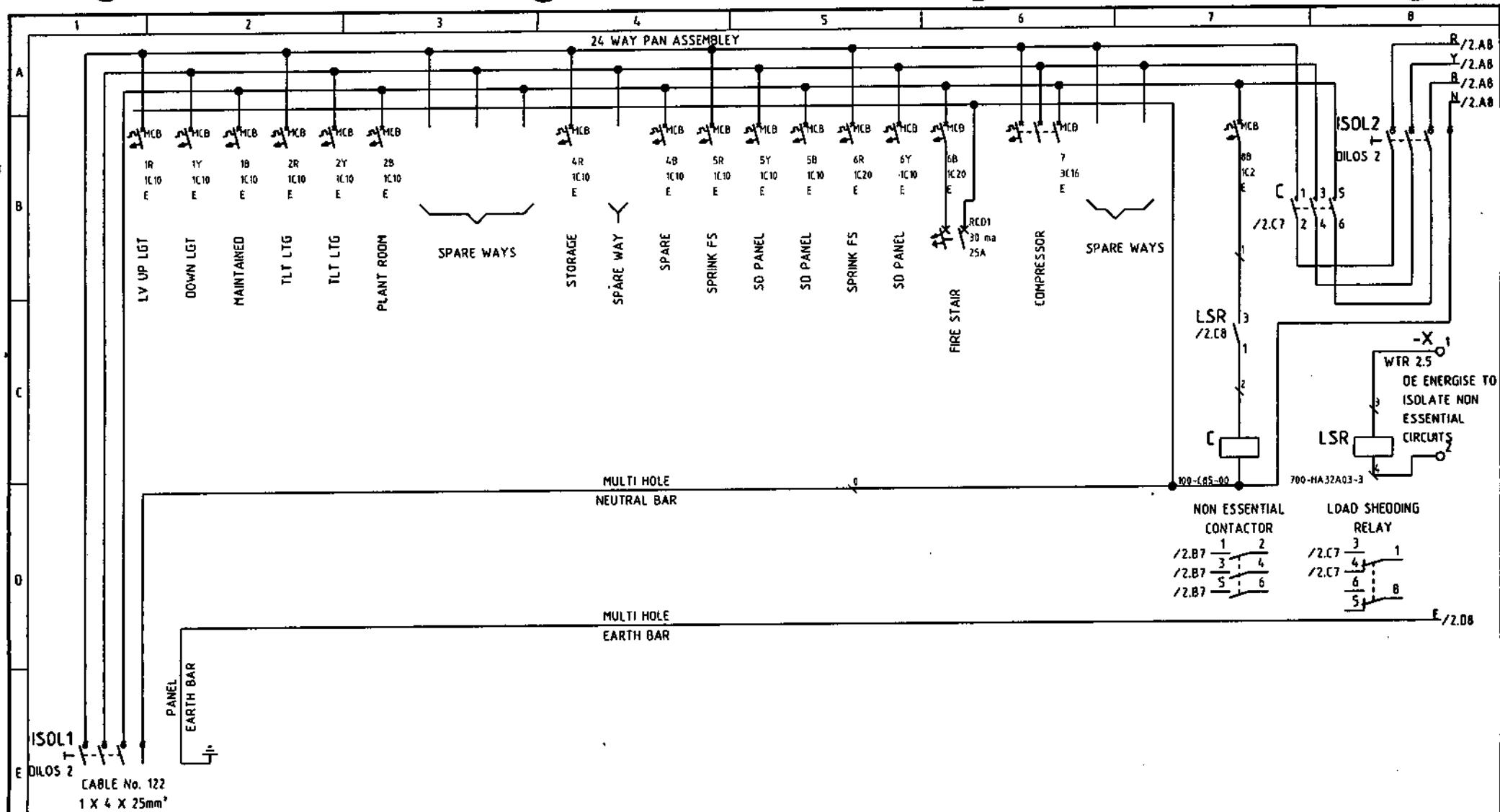
Client:
T. CLARKE PLC

CONSULTANT:
OVE ARUP & PARTNERS

Drawing No.
558/D/1

Revision
1

Sheet
1
of



SUPPLY FROM
SB01

CERTIFIED FINAL

DATE: 21.10.1998

A.T

DISTRIBUTION BOARD LG/EL1

Name	Date						
Drawn J. McEVoy	05-08-98						
Chkd							
Appd							

Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD LG/L1 & LG/EL1
LG/EL1 POWER SCHEMATIC

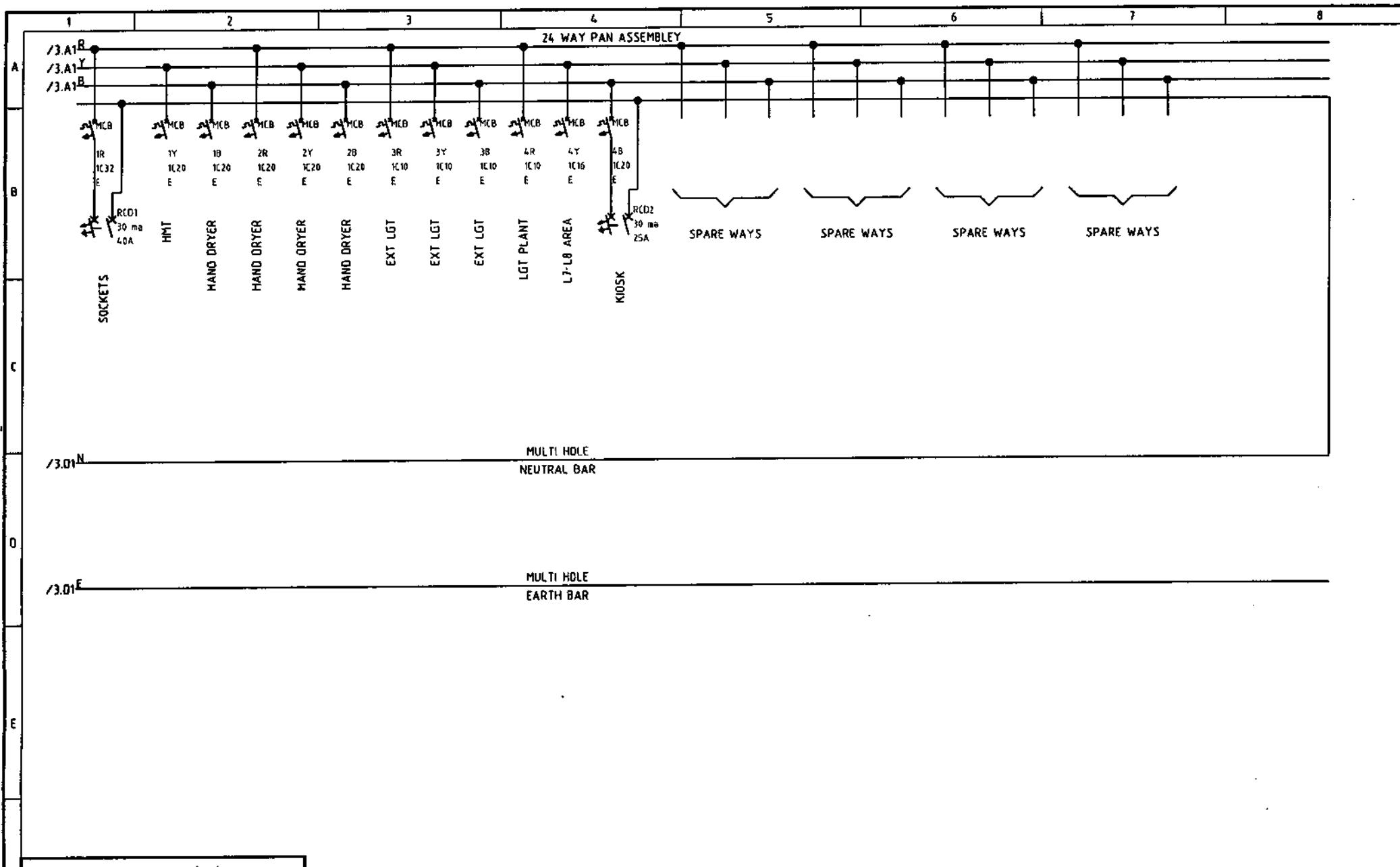
Client
T. CLARKE PLC

Consultant
OVE ARUP & PARTNERS

Drawing No.
558/D/2

Revision
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Sheet
2



CERTIFIED FINAL

DATE: 21.10.1998

A.T

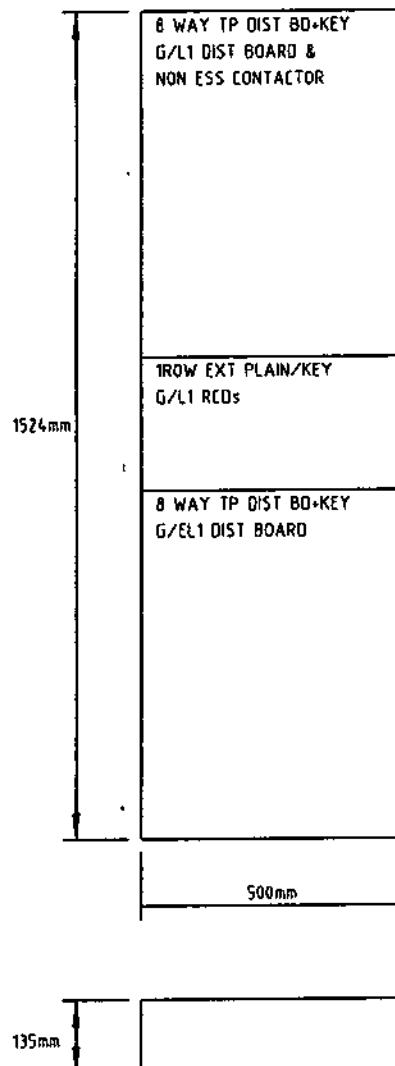
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Chkd				CONSULTANT		2	of
App'd				DVE ARUP & PARTNERS			



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS

R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL

DATE: 21.10.1998

A-7

Name	Date	App'd
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



Project:
5-7 CARLTON GARDENS
LONDON

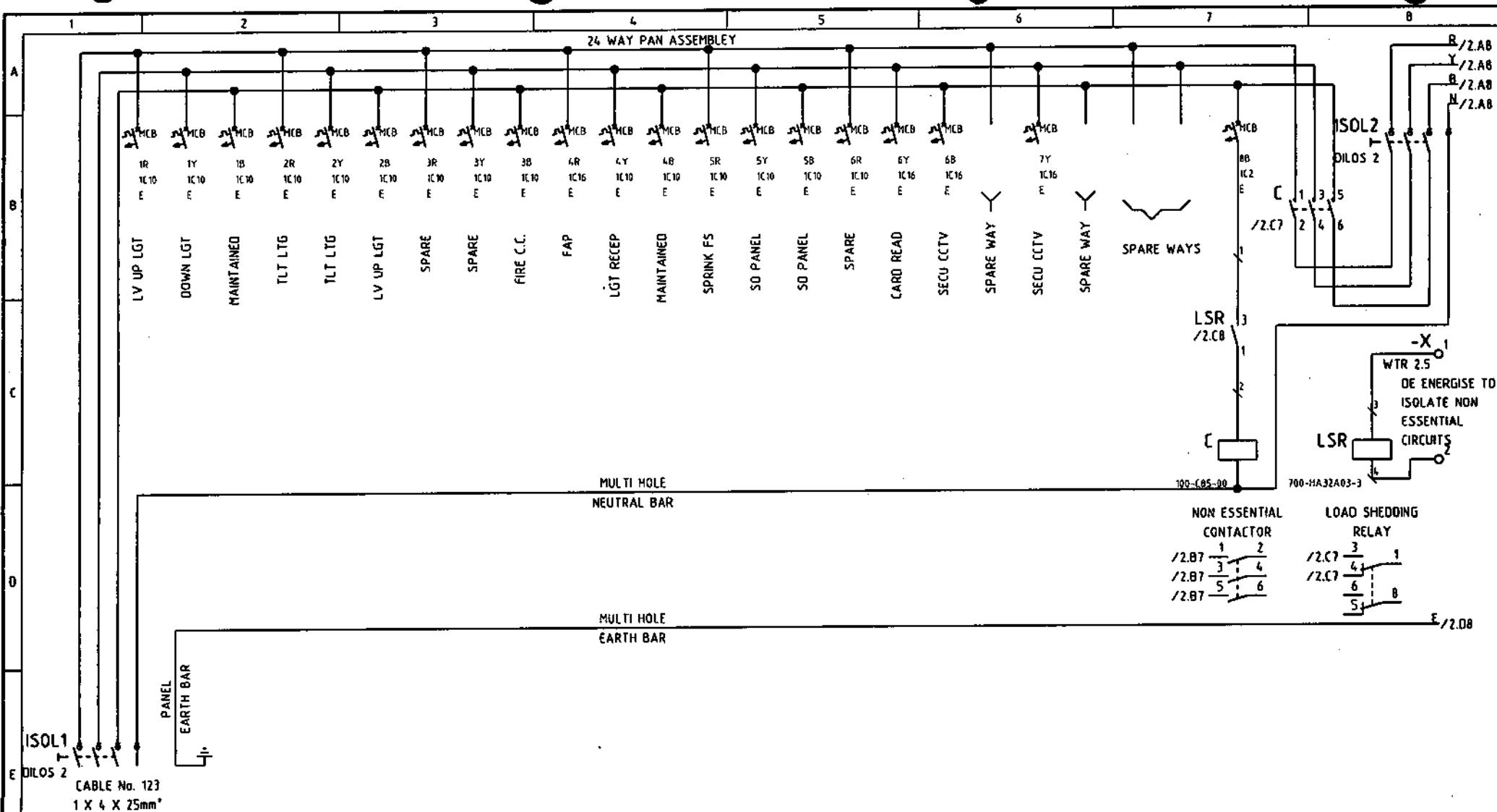
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L/LORD G/L1 & G/EL1
GENERAL ARRANGEMENT

Client:
T. CLARKE PLC

CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
55B/E1/1

Revision
Sheet
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of



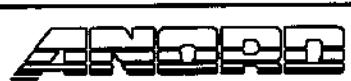
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DATE: 21.10.1998

A.T

DISTRIBUTION BOARD G/EL1

Name	Date
Drawn J. McEVoy	05-08-98
Chkd	
App'd	



Project
5-7 CARLTON GARDENS
LONDON

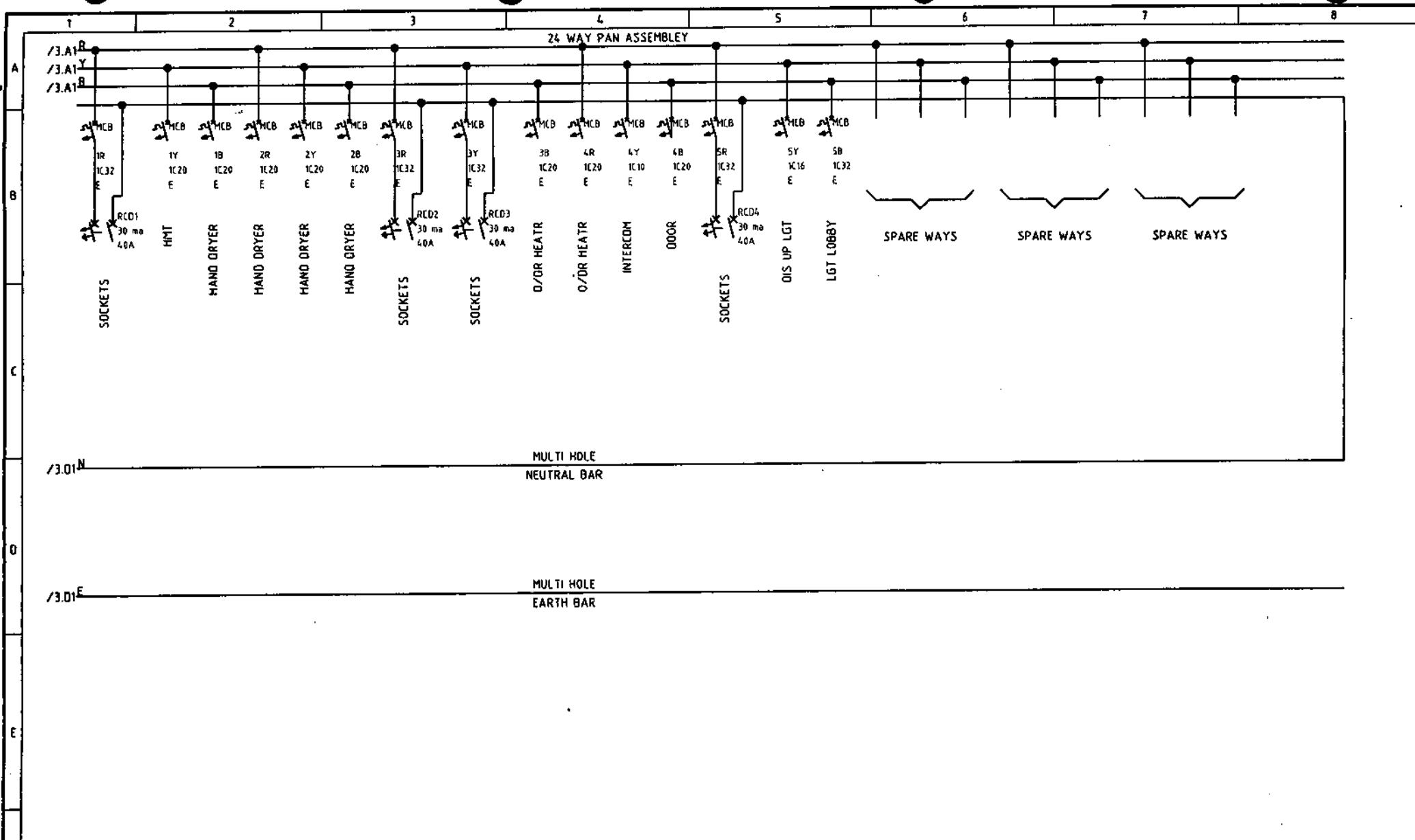
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L/LORD G/L1 & G/EL1
G/EL1 POWER SCHEMATIC

Client
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
SSB/E1/2

Revision
1
of
2



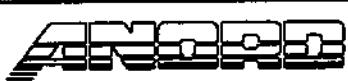
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DATE: 21.10.1998

A.7

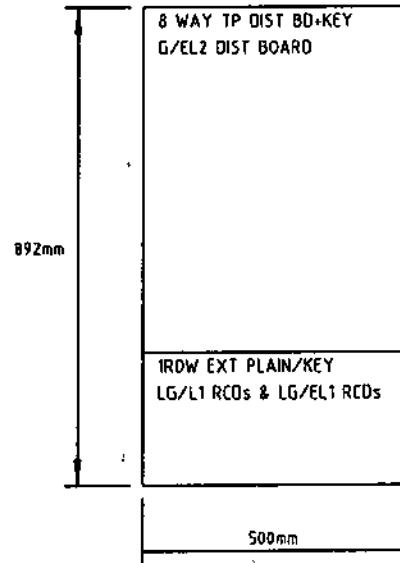
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Chkd							
App'd							



1 2 3 4 5 6 7 8

GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS

R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL

DATE: 21.10.1998

A-T

Name	Date
Drawn J. McEVoy	05-08-98
Dk'd	
App'd	



Project
5-7 CARLTON GARDENS
LONDON

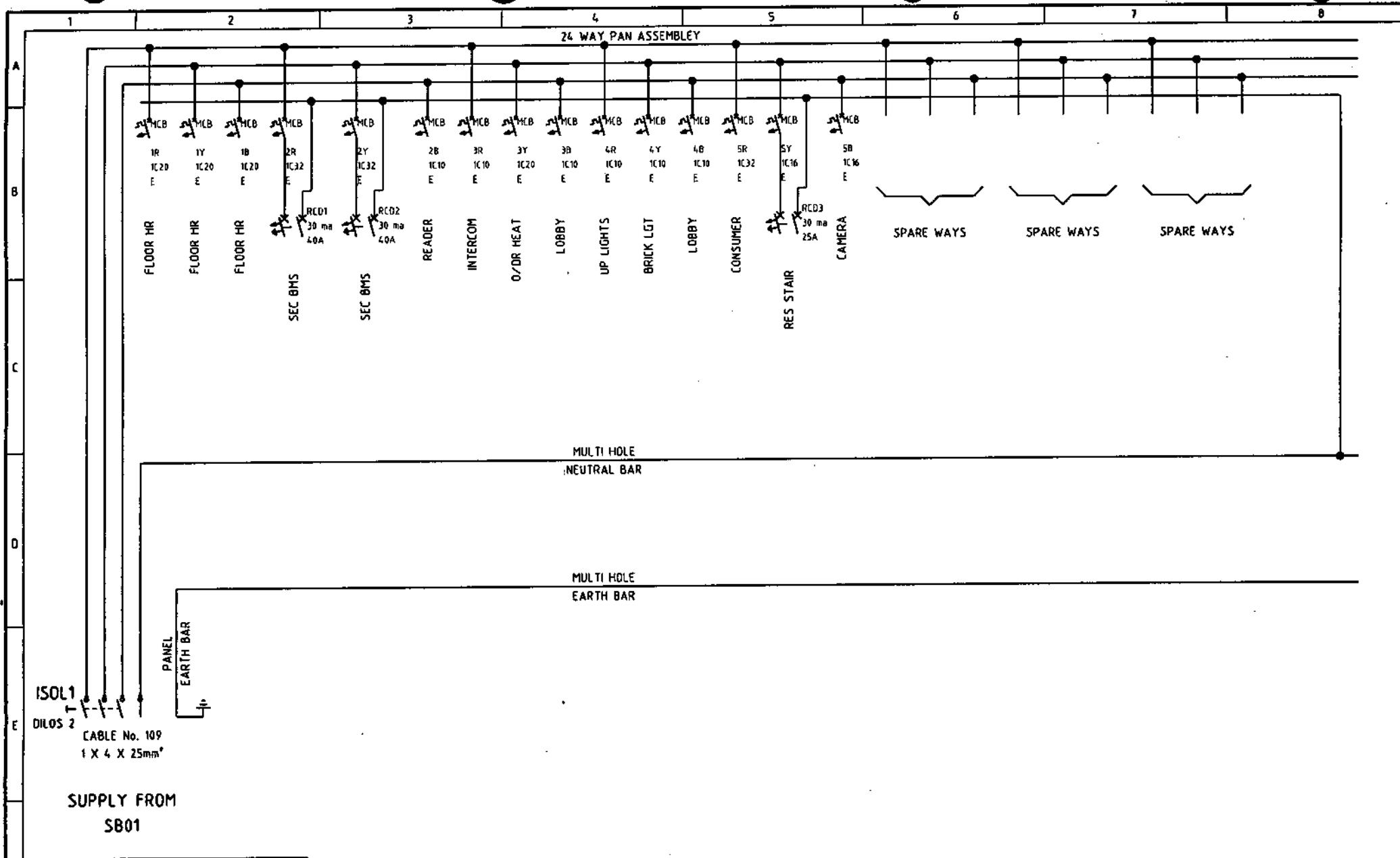
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L/LORD G/EL2
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

CONSULTANT
DOVE ARUP & PARTNERS

Drawing No.
558/E2/1

Revision
Sheet
1
of



CERTIFIED FINAL

DATE: 21.10.1998

DISTRIBUTION BOARD G/EL2

A-7



**Project
5-7 CARLTON GARDENS
LONDON**

**Title
L/LORD G/EL2
G/EL2 POWER SCHEMATIC**

**Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS**

**Drawing No.
558/E2/2**

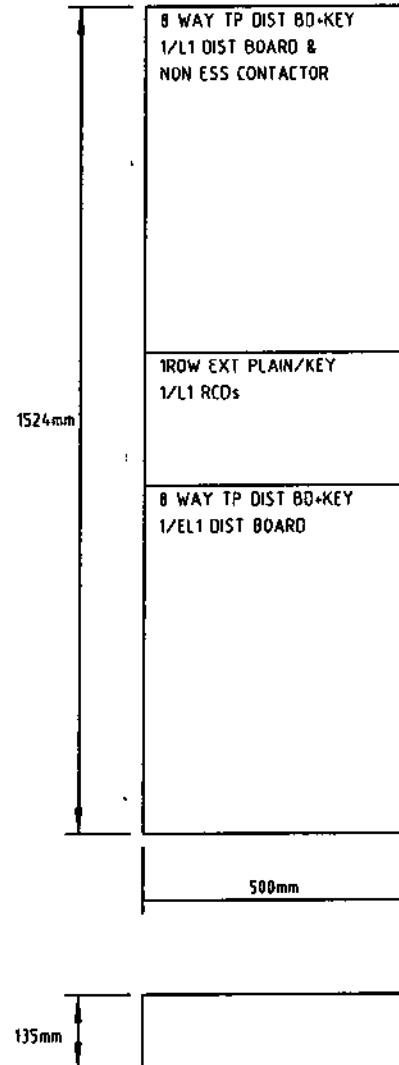
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1
of
2**

Name	Date	
Drawn J. McEVY	05-08-98	
Chkd 		
App'd 		

1 2 3 4 5 6 7 8

A
B
C
D
E
F

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

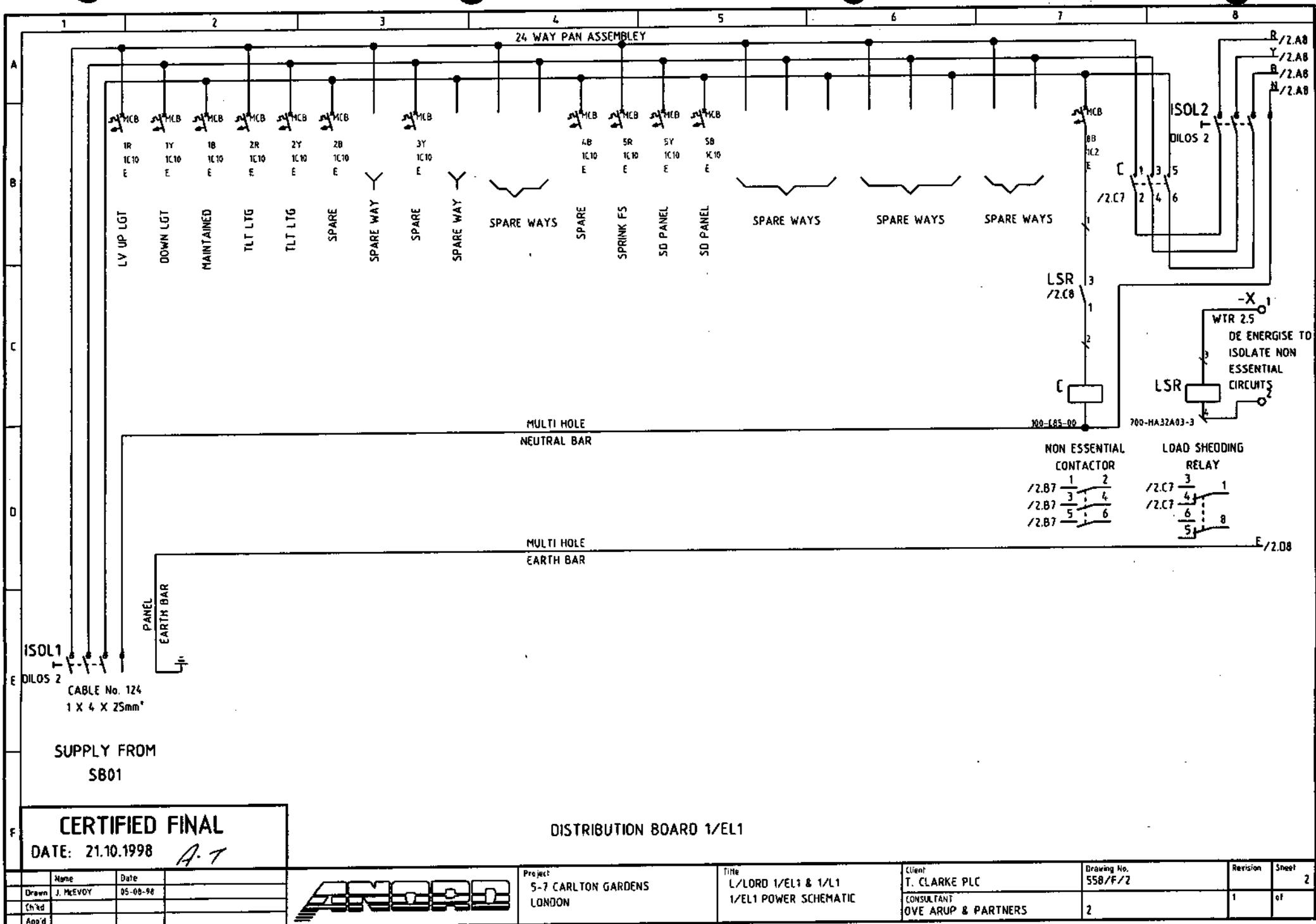
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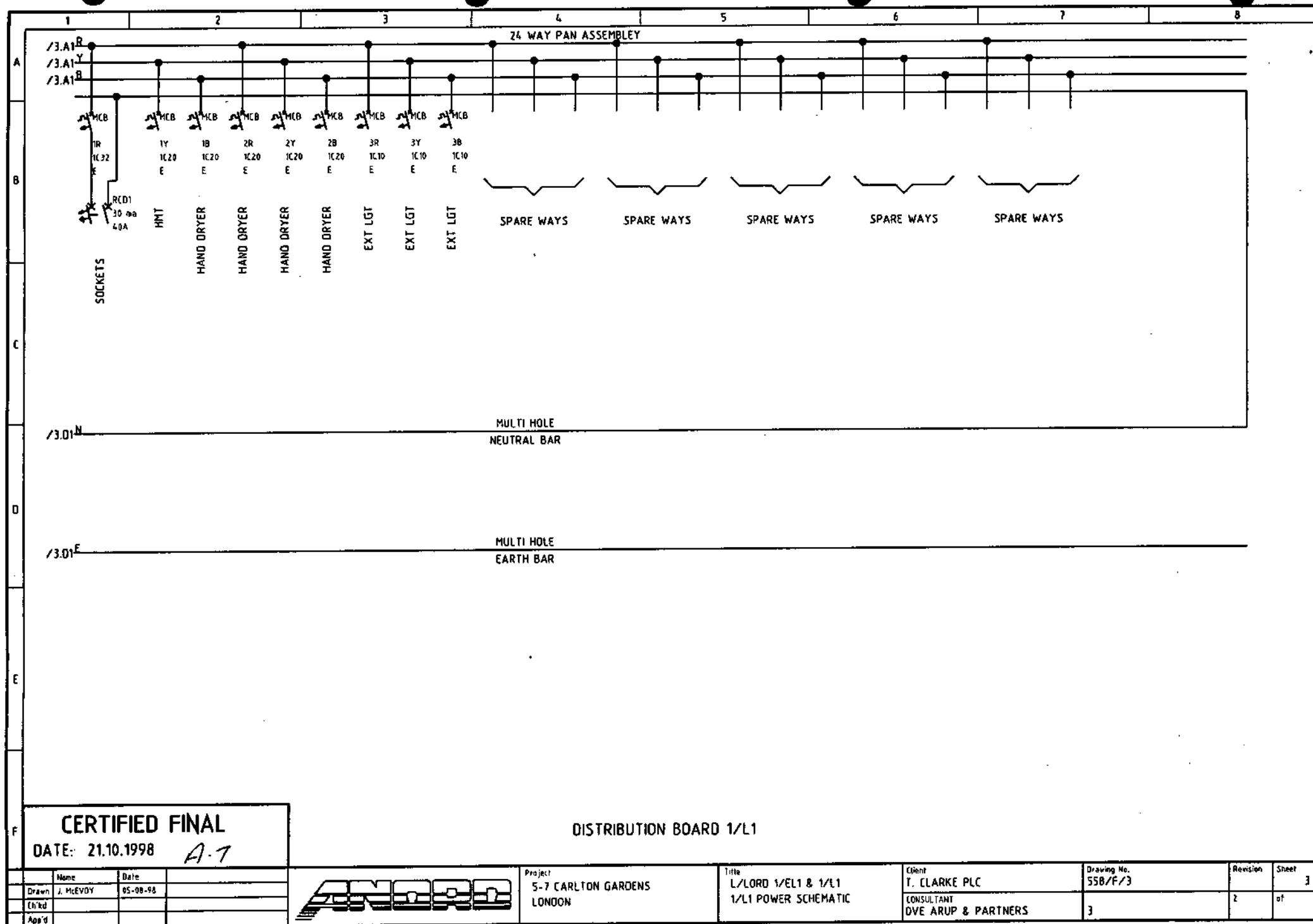
DATE: 21.10.1998

A.T

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Checkd						CONSULTANT			
App'd						DVE ARUP & PARTNERS	1		of

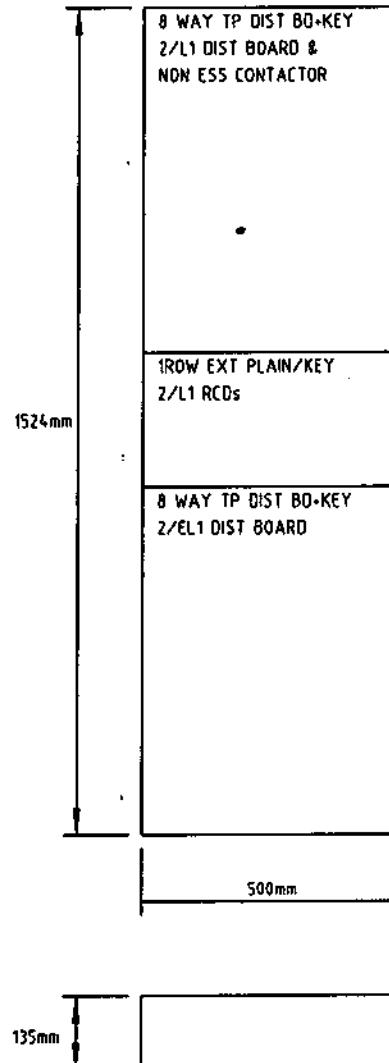






1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS

R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL

DATE: 21.10.1998

A.1

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

Title
U/LORD 2/EL1 & 2/L1
GENERAL ARRANGEMENT

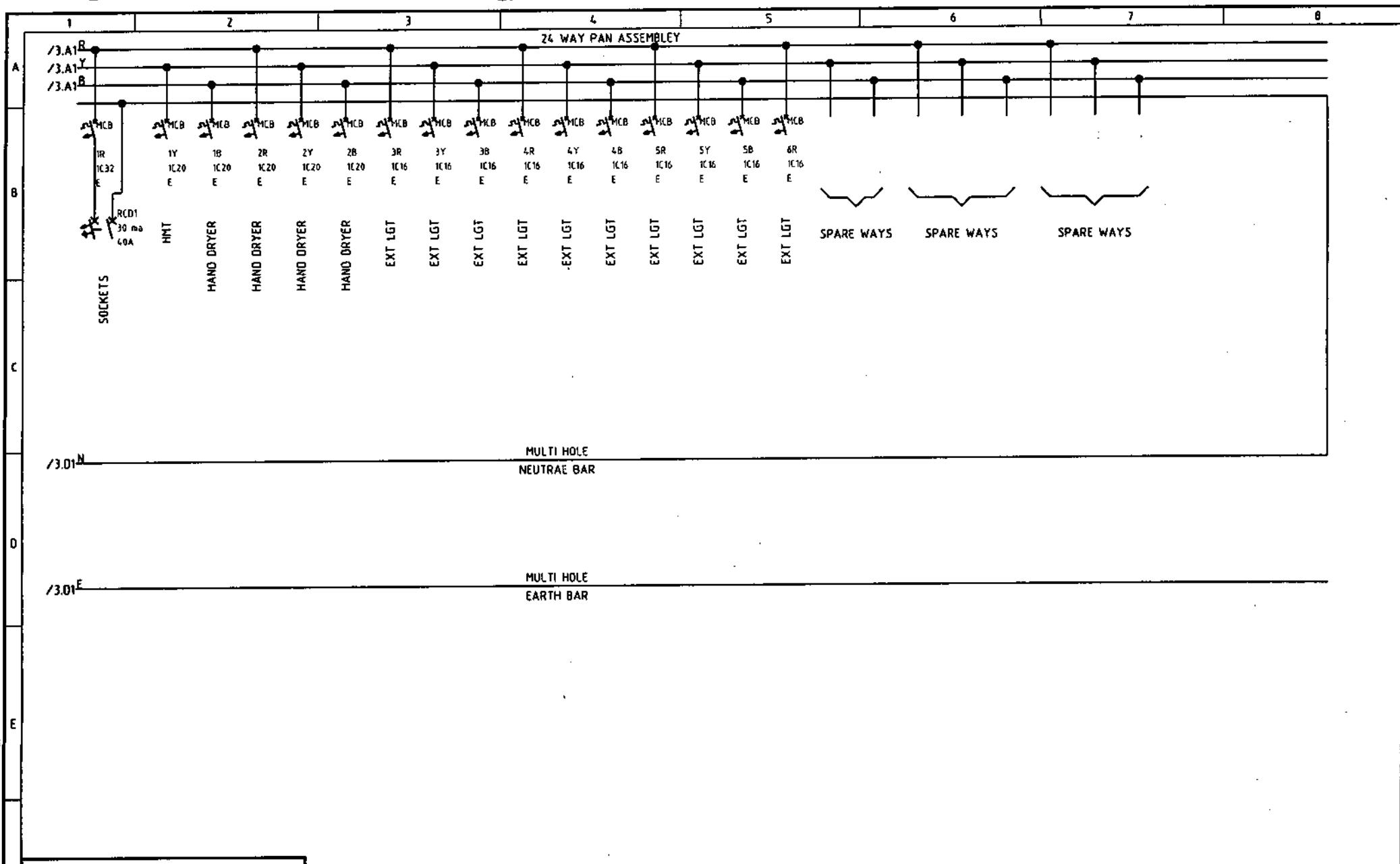
Client
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/G/1

Revision
of

1



CERTIFIED FINAL
DATE: 21.10.1998 *A.7*

DISTRIBUTION BOARD 2/L1



Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD 2/EL1 & 2/L1
2/L1 POWER SCHEMATIC

Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS

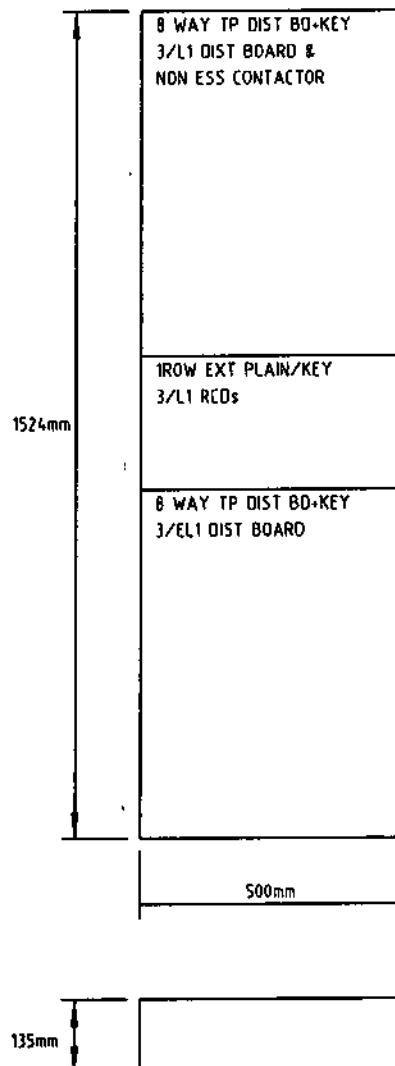
Drawing No.
558/G/3

Revision
2
Sheet
3
of

Drawn	Name	Date	
	J. McEVoy	05-08-98	
Chkd			
App'd			

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

f CERTIFIED FINAL
DATE: 21.10.1998 A.7

	Name	Date
Drawn	J. McEVOLY	05-08-98
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

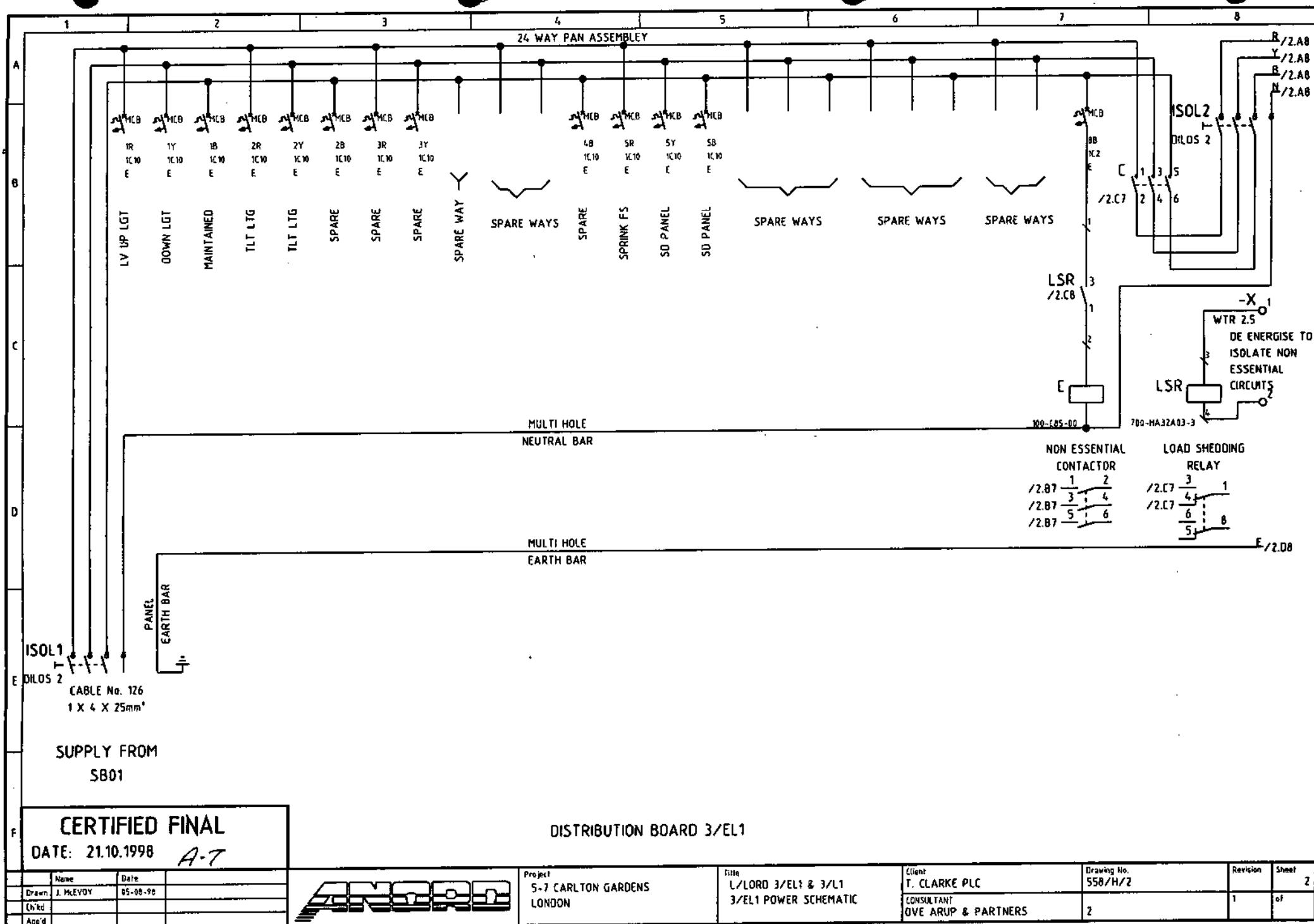
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L/LORD 3/EL1 & 3/L1
GENERAL ARRANGEMENT

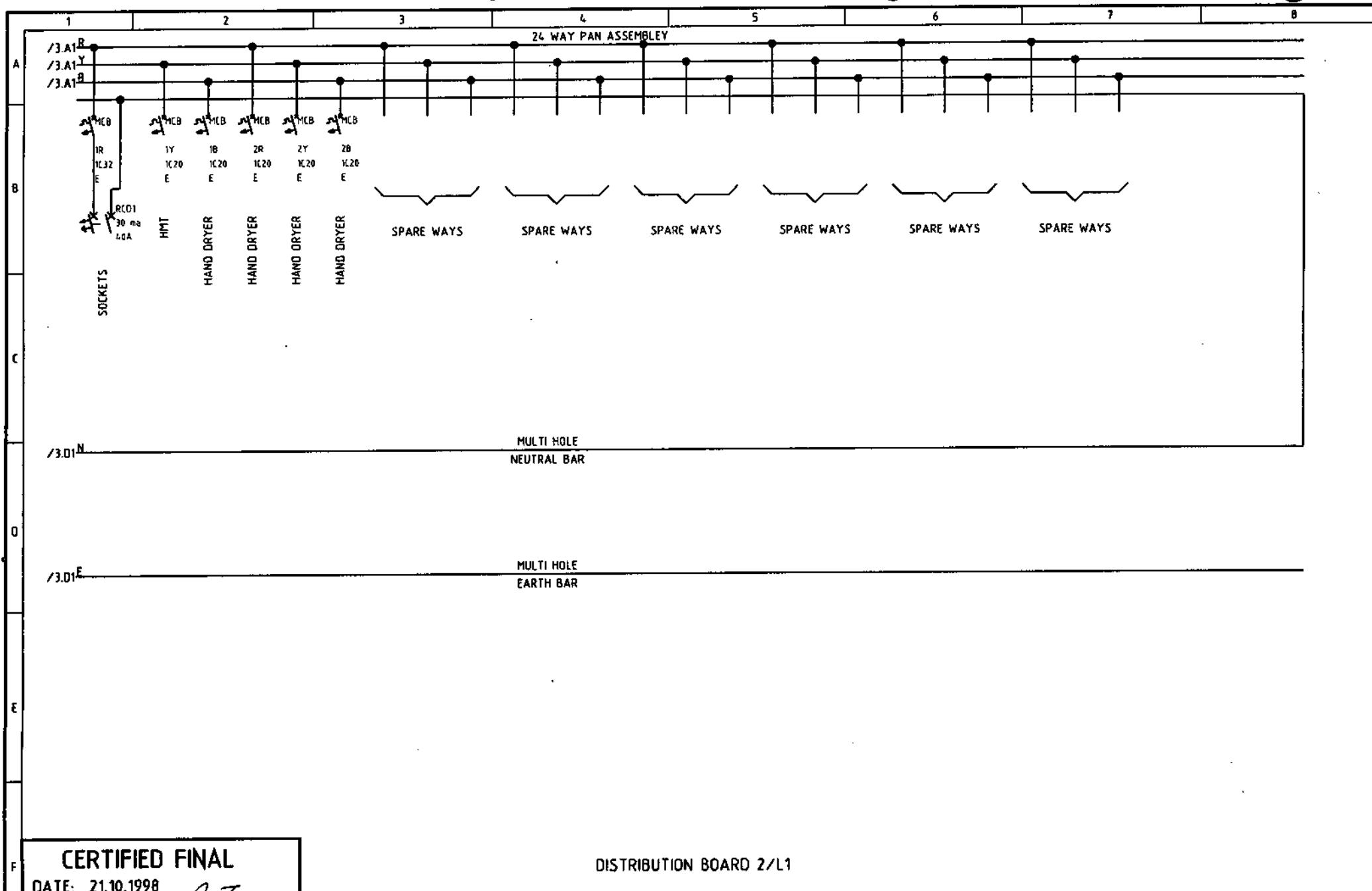
Client
T. CLARKE PLC

Consultant
DVE ARUP & PARTNERS

Drawing No.
558/H/1

Revision
Sheet
1
of





CERTIFIED FINAL

DATE: 21.10.1998

DISTRIBUTION BOARD 2/L1

	Name	Date	
Drawn	J. McEVOLY	05-08-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD 3/EL1 & 3/L1
3/L1 POWER SCHEMATIC

T. CLARKE PLC

Drawing No.
558/H/3

Revision Sheet 3
2 of

1 2 3 4 5 6 7 8

GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032

A
B
C
D
E
F

8 WAY TP DIST BD+KEY
4/L1 DIST BOARD &
NON ESS CONTACTOR

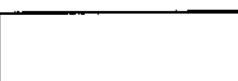
1524mm

1ROW EXT PLAIN/KEY
4/L1 RCDs

8 WAY TP DIST BD+KEY
4/EL1 DIST BOARD

500mm

135mm



CABLE COLOURS			
R PHASE	= RED		
S PHASE	= YELLOW		
T PHASE	= BLUE		
NEUTRAL	= BLACK		

F

CERTIFIED FINAL
DATE: 21.10.1998 A.T.

Name	Date	
Drawn	J. McEVoy	05-08-98
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD 4/EL1 & 4/L1
GENERAL ARRANGEMENT

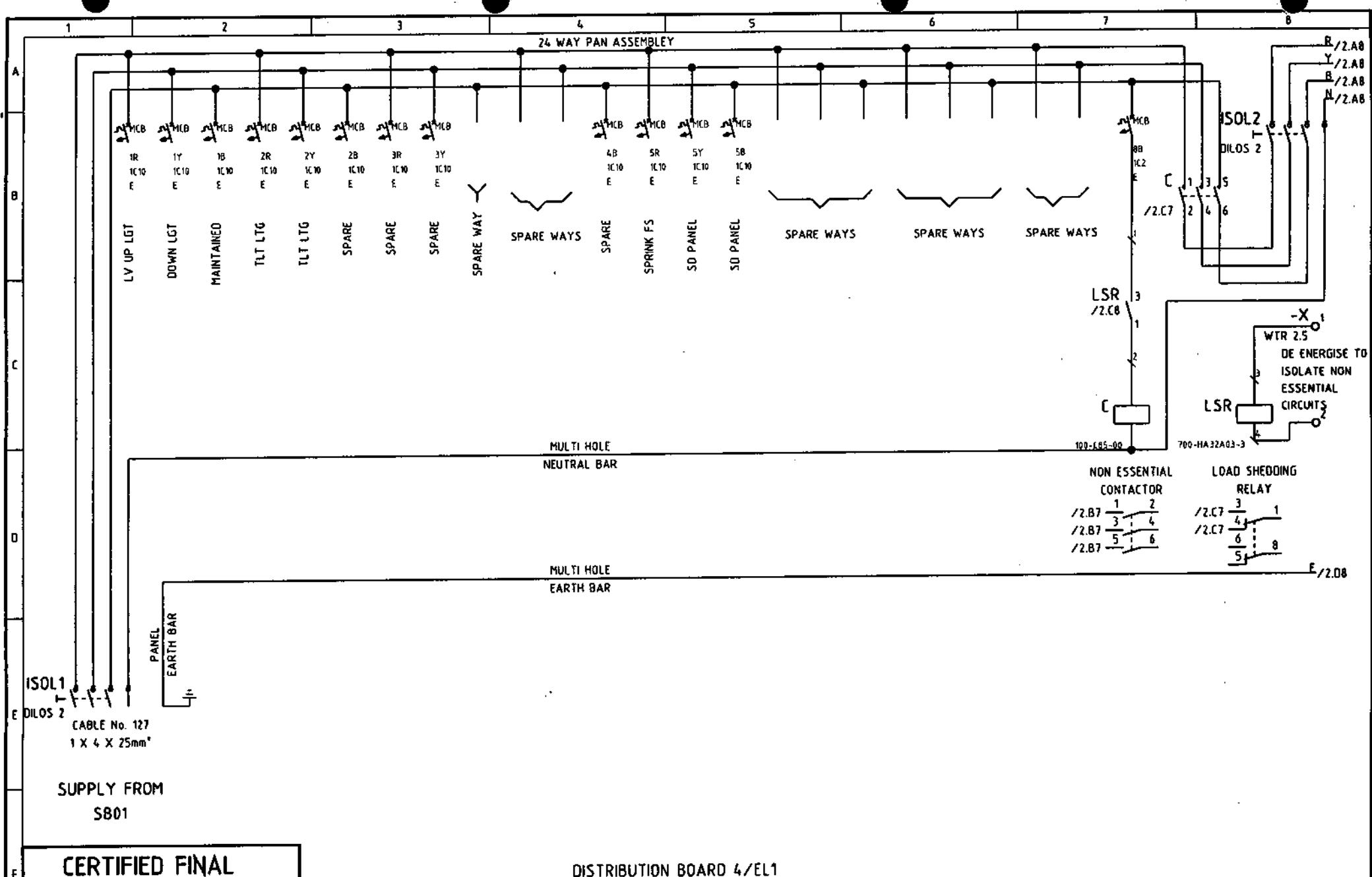
Client
T. CLARKE PLC

CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
558/J/1

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Sheet
1
of

1

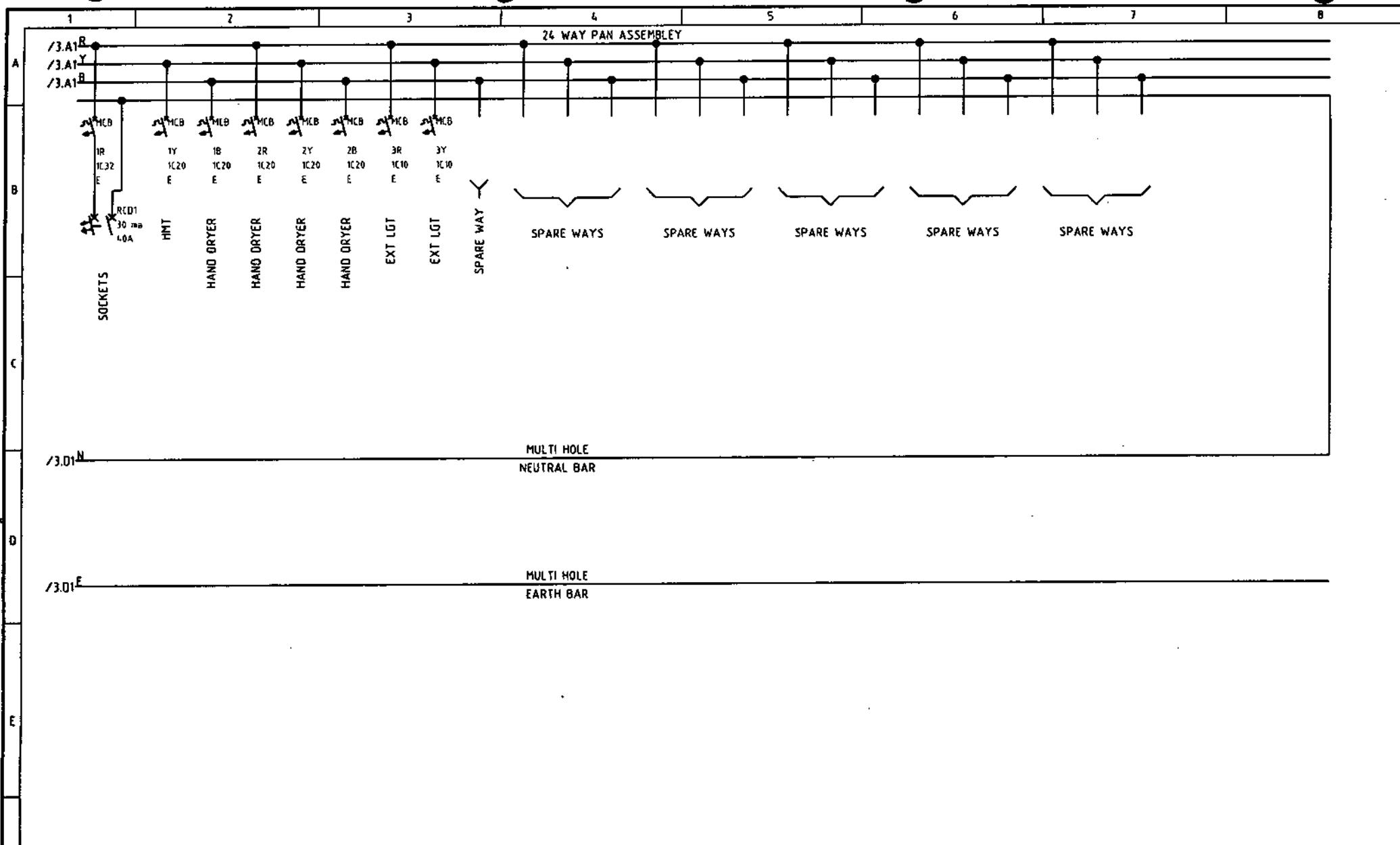


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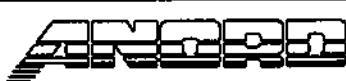
DATE: 21.10.1998

DISTRIBUTION BOARD 4/EL1

F CERTIFIED FINAL			DISTRIBUTION BOARD 4/EL1							
DATE: 21.10.1998 A.T.										
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J. McEVoy		05-08-98			5-7 CARLTON GARDENS LONDON	L/LORD 4/EL1 & 4/L1 4/EL1 POWER SCHEMATIC	T. CLARKE PLC CONSULTANT DOE ARUP & PARTNERS	558/1/2	1	2
Chkd										
App'd										



CERTIFIED FINAL		
DATE: 21.10.1998 <i>A.J.</i>		
Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



DISTRIBUTION BOARD 4/L1

Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD 4/EL1 & 4/L1
4/L1 POWER SCHEMATIC

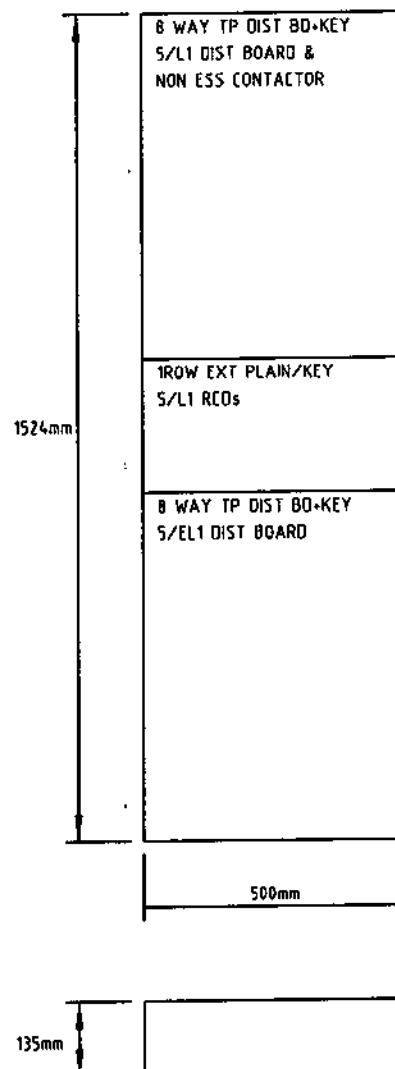
Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
558/J/3
2
of

Revision
Sheet
3

1 2 3 4 5 6 7 8

GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS

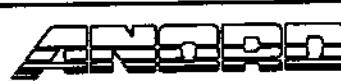
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL

DATE: 21.10.1998

A.T.

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

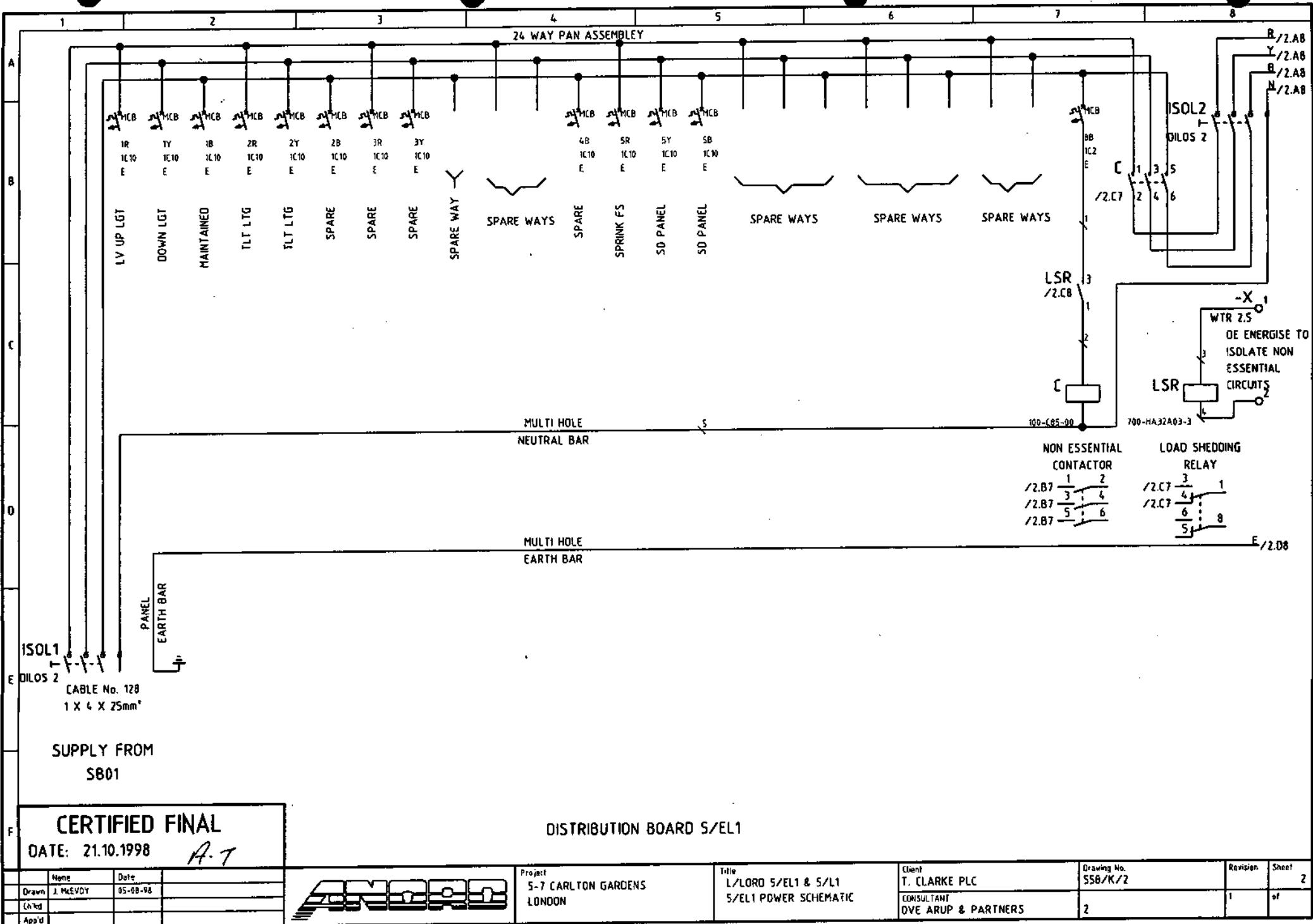
Title
L/LORD S/EL1 & S/L1
GENERAL ARRANGEMENT

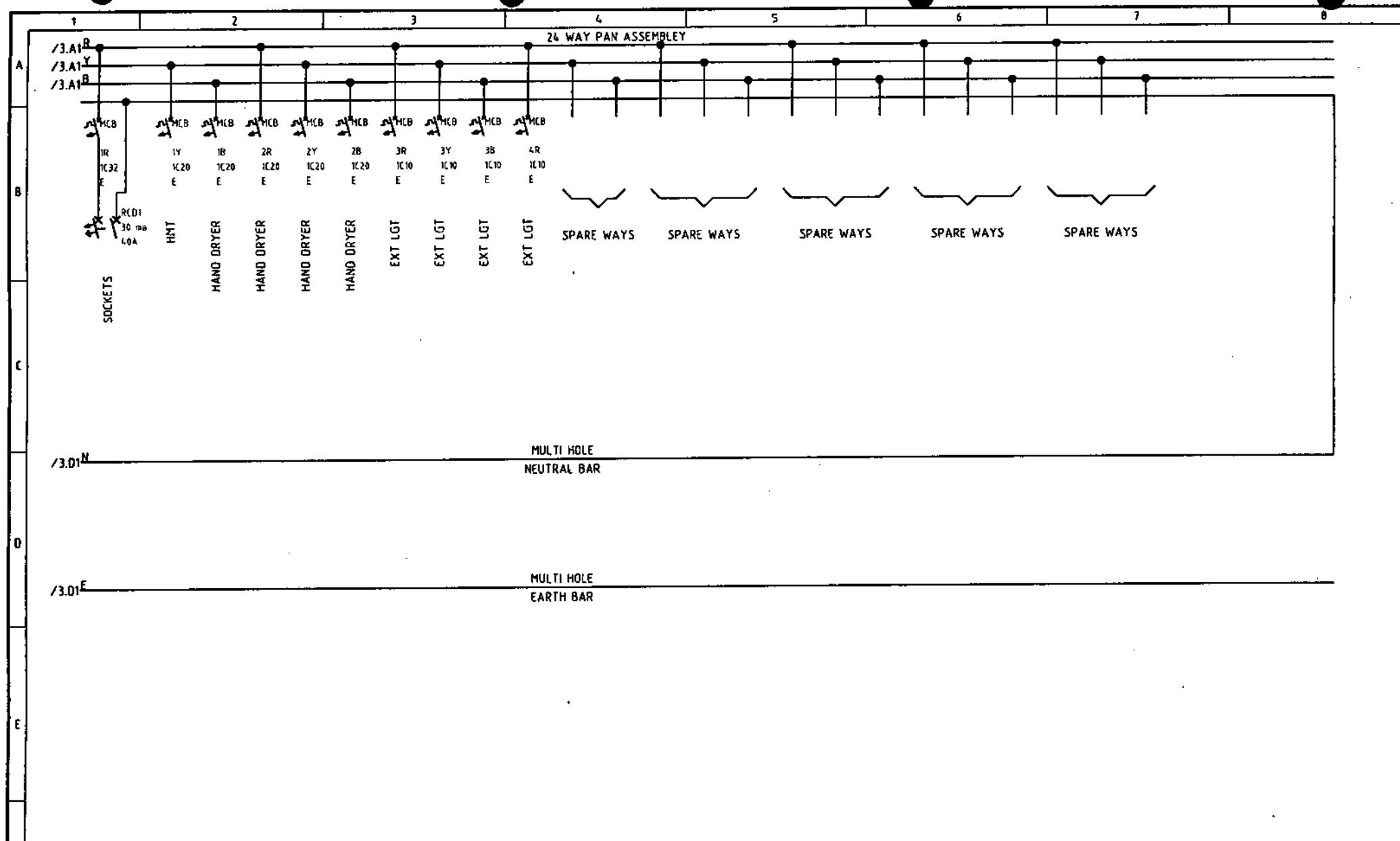
Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
SSB/K/1

Revision
of

1





CERTIFIED FINAL

DATE: 21.10.1998

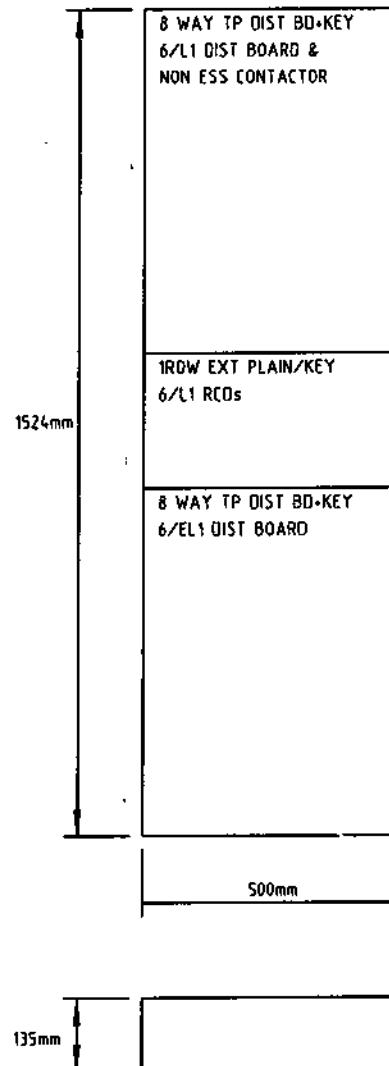


DISTRIBUTION BOARD 5/L1

DATE: 21.10.1998	A.T						
	Name	Date					
Drawn	J. McEVYD	05-08-98					
Unkd							
Amend							
		Project S-7 CARLTON GARDENS LONDON	Title L/LORD S/EL1 & S/L1 S/L1 POWER SCHEMATIC	Client T. CLARKE PLC	Drawing No. 558/K/3	Revision 2	Sheet 3 of
				CONSULTANT DOE ARUP & PARTNERS	3		

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998 AT

Name	Date	
Drawn J. McLEVOY	05-08-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

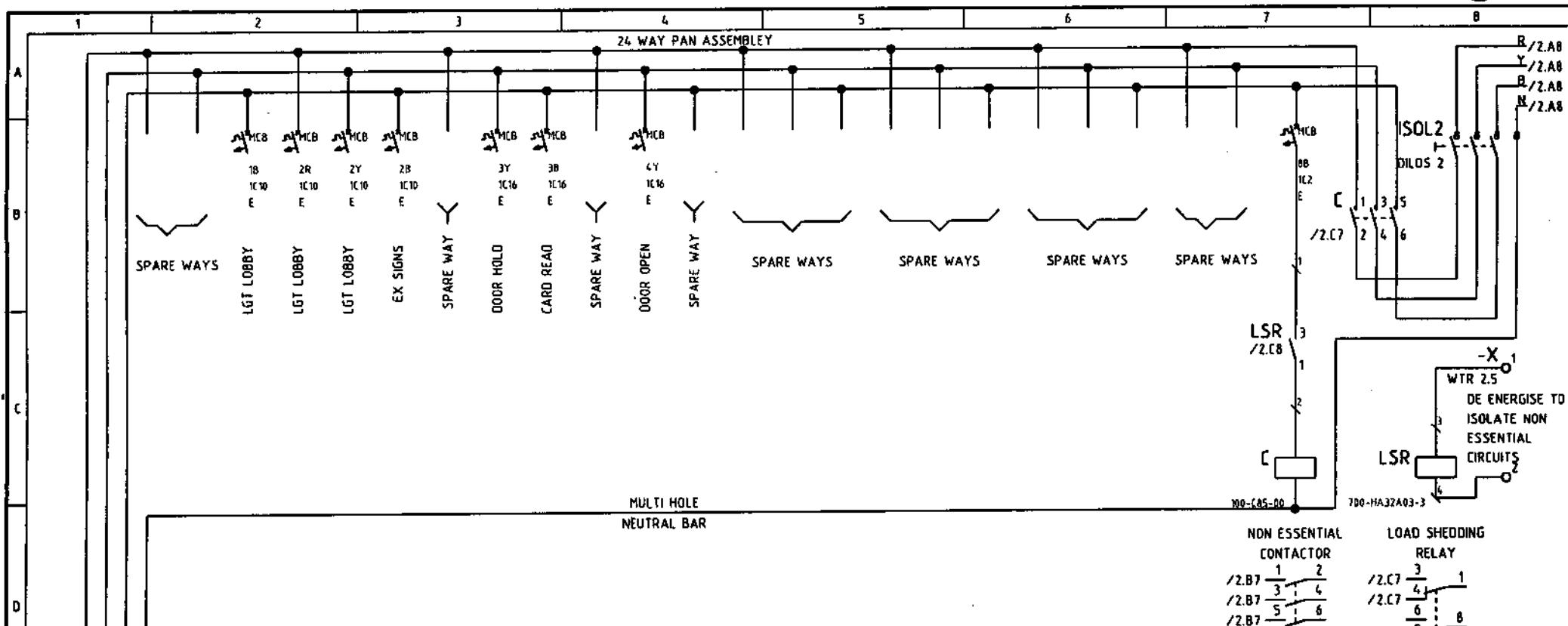
Title
L/LORD 6/EL1 & 6/L1
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
OVE ARUP & PARTNERS

Drawing No.
558/L/1

Revision
Sheet 1
of



ISOL1
ISOL2
CABLE No. 129
1 X 4 X 25mm²

SUPPLY FROM
SB01

CERTIFIED FINAL	
DATE: 21.10.1998 A-T	
Name	Date
Drawn J. McEVY	DS-08-98
Chkd	
App'd	



DISTRIBUTION BOARD 6/EL1

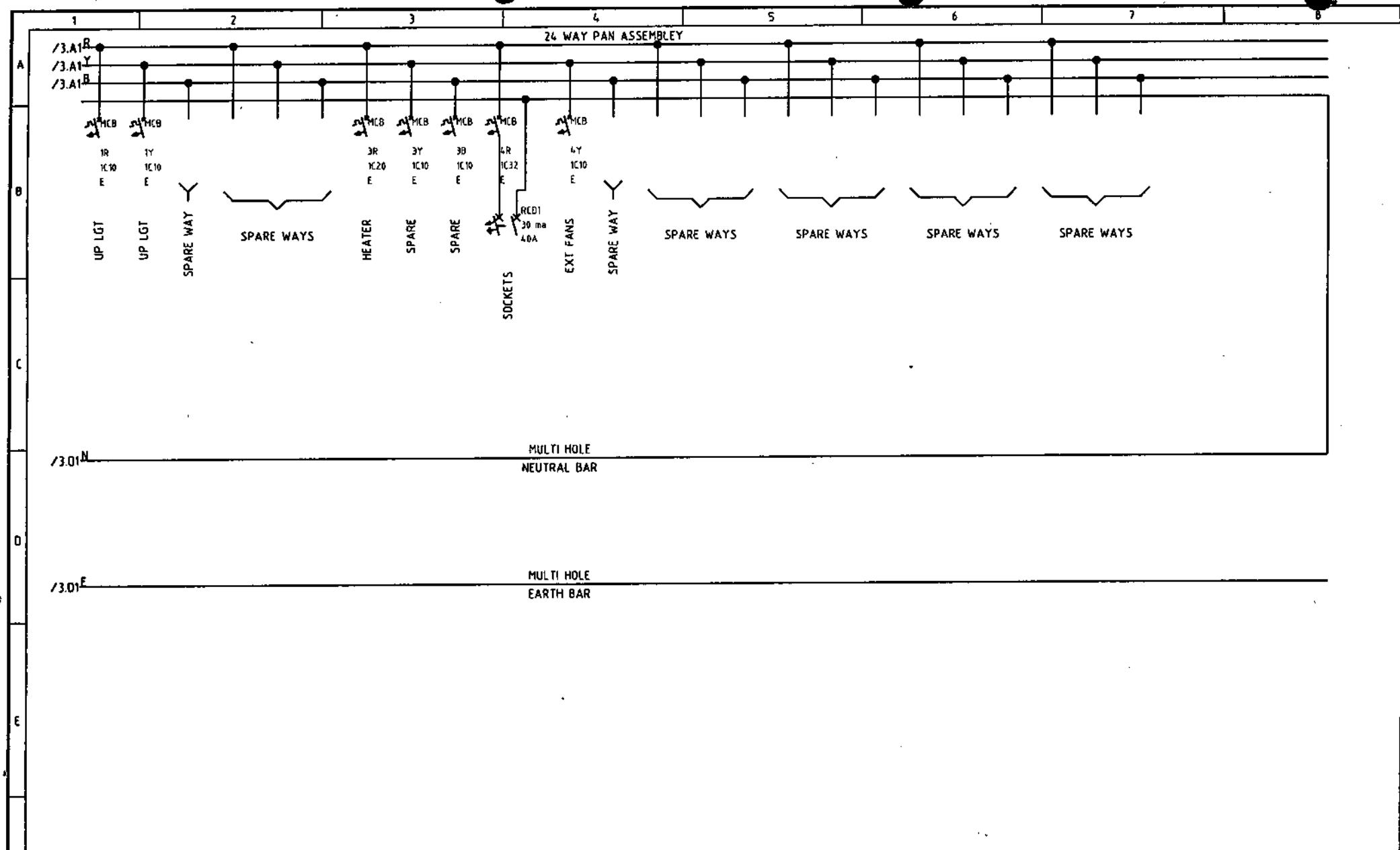
Project
5-7 CARLTON GARDENS
LONDON

Title
6/LORD 6/EL1 & 6/L1
6/EL1 POWER SCHEMATIC

Client
T. CLARKE PLC
Consultant
OVE ARUP & PARTNERS

Drawing No.
550/L/2

Revision
1
Sheet
2



CERTIFIED FINAL

DATE: 21.10.1998

A-Z

DISTRIBUTION BOARD 6/L1

DATE: 21.10.1998			A.T								
Drawn	Name J. McEVoy	Date 05-08-98									
Enkd											
App'd											
			Project 5-7 CARLTON GARDENS LONDON	Title L/LORD 6/E1 & 6/L1 6/L1 POWER SCHEMATIC	Client T. CLARKE PLC	Drawing No. 556/L/3	Revision Z	Sheet 3			
				CONSULTANT OVE ARUP & PARTNERS	3						

1

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8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032

8 WAY TP DIST BD+KEY
7/L1 DIST BOARD &
NON ESS CONTACTOR

1524mm

1ROW EXT PLAIN/KEY
7/L1 RCDs

8 WAY TP DIST BD+KEY
7/EL1 DIST BOARD

500mm

135mm

CABLE COLOURS

R PHASE = RED

S PHASE = YELLOW

T PHASE = BLUE

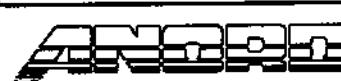
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CERTIFIED FINAL

DATE: 21.10.1998

A/T

	Name	Date	
Drawn	J. McEVoy	05-08-98	
Chkd.			
App'd			



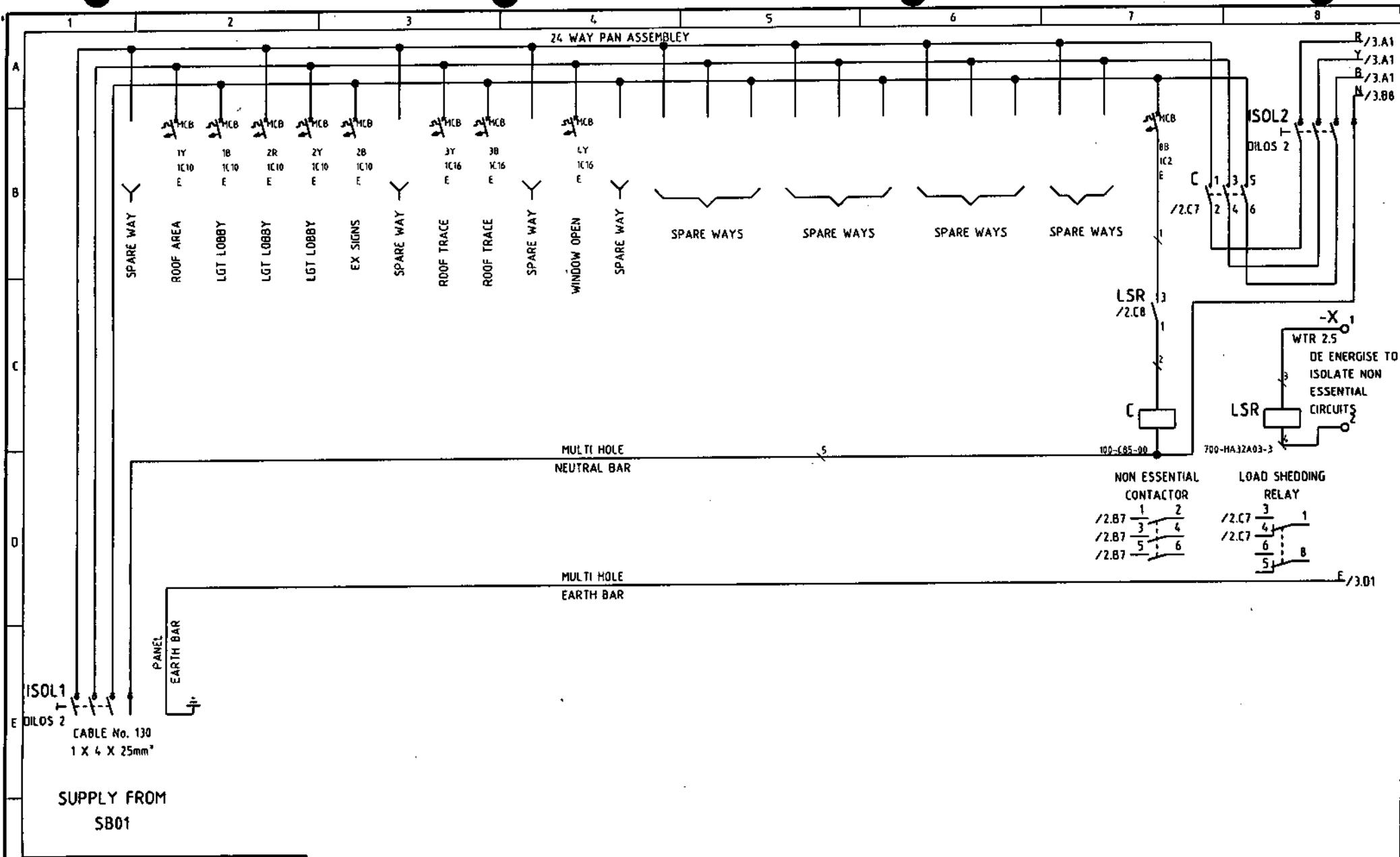
Project
5-7 CARLTON GARDENS
LONDON

Title
L/LORD 7/EL1 & 7/L1
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
DOE ARUP & PARTNERS

Drawing No.
558/M/1

Revision
1
of



CERTIFIED FINAL

DATE: 21.10.1998

A.7

DISTRIBUTION BOARD 6/EL1



**Project
5-7 CARLTON GARDENS
LONDON**

**Title
L/LORD 7/EL1 & 7/L1
7/EL1 POWER SCHEMATIC**

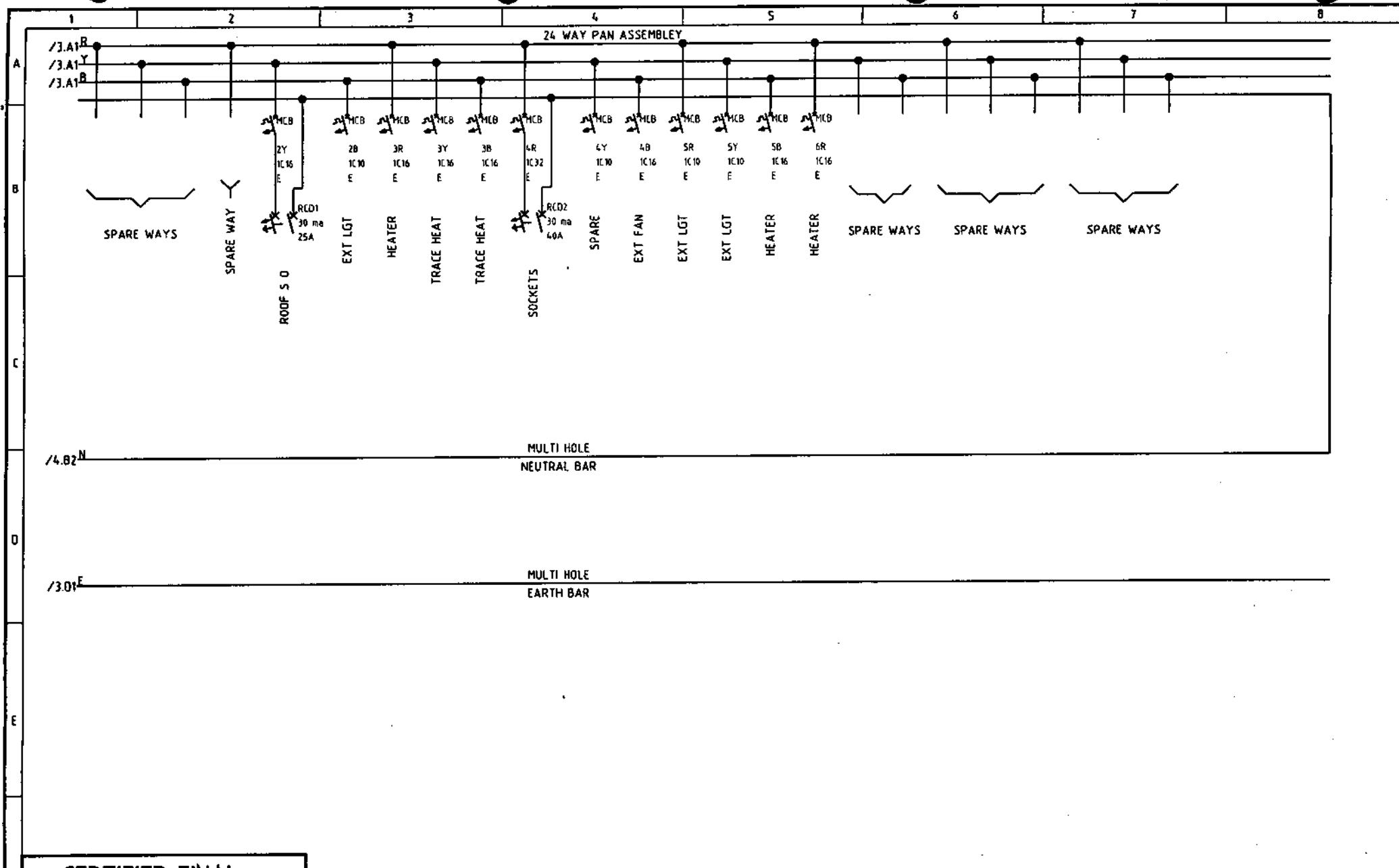
**Client
T. CLARKE PLC**

**CONSULTANT
DVE ARUP & PARTNERS**

**Drawing No.
558/M/2**

**Revision
1 of 2**

	Name	Date
Drawn	J. McEVoy	05-08-98
Chkd		
App'd		



CERTIFIED FINAL

DATE: 21.10.1998

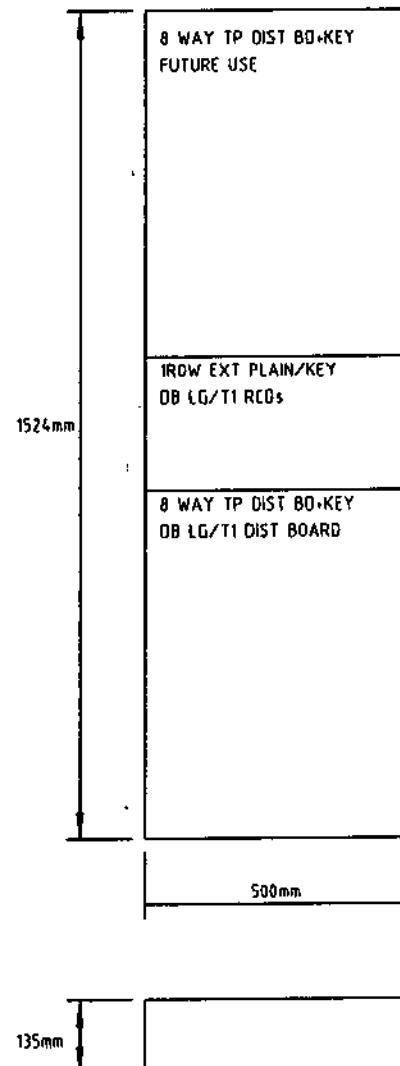
DISTRIBUTION BOARD 7/L1

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEVoy	05-08-98	5-7 CARLTON GARDENS LONDON	L/LORD 7/EL1 & 7/L1 7/L1 POWER SCHEMATIC	T. CLARKE PLC CONSULTANT DOVE ARUP & PARTNERS	558/M/3	2	3
Chkd							
App'd							



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

CERTIFIED FINAL

DATE: 21.10.1998

A.T

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

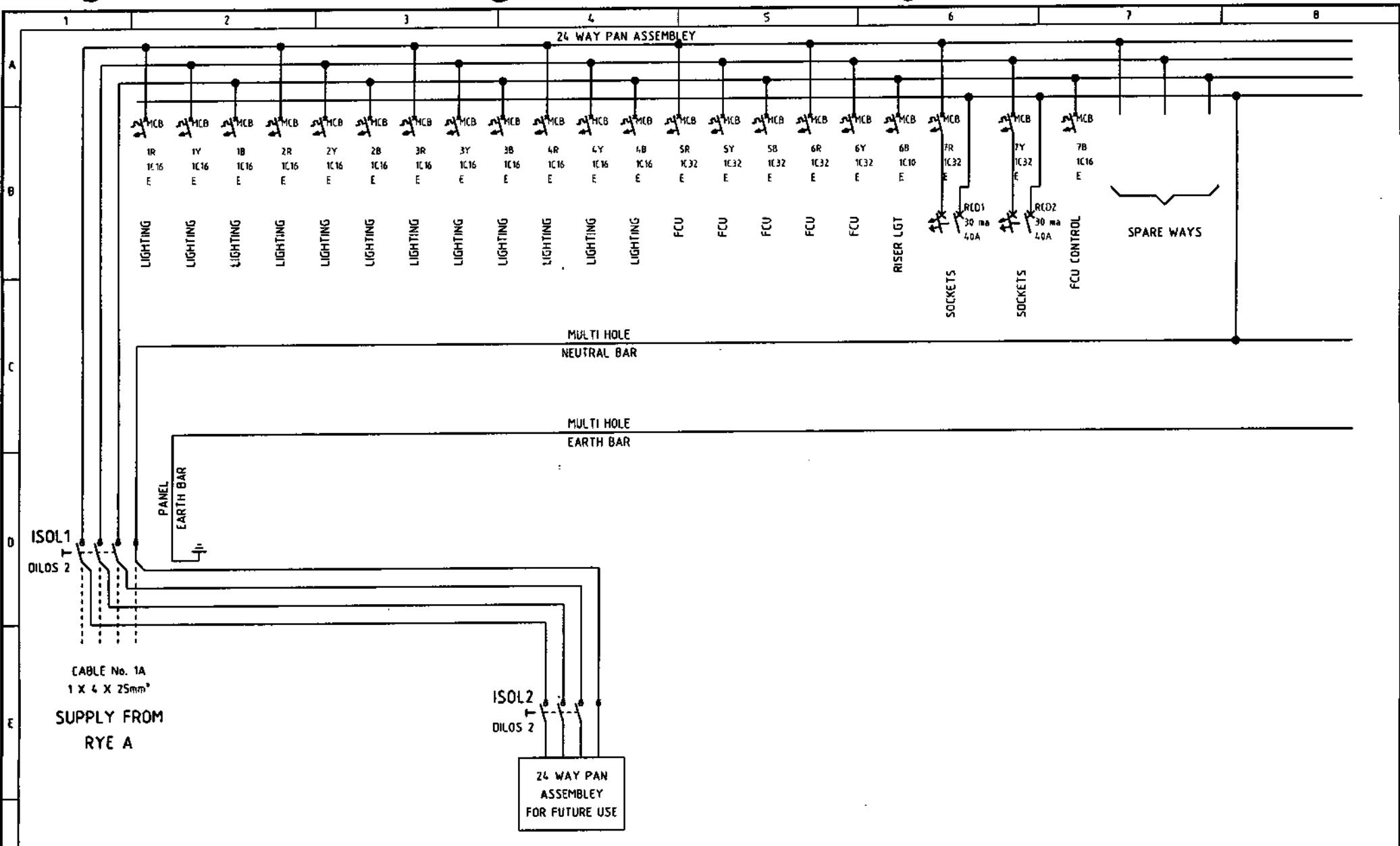
Title
DB LG/T1
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
558/N1/1

Revision A
of 1



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DATE: 21.10.1998

A.T

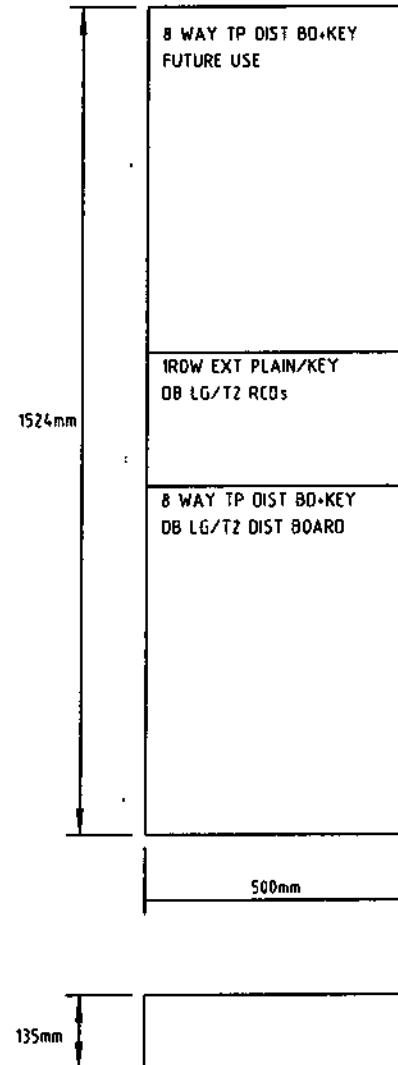
DISTRIBUTION BOARD LG/T1

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
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Chkd						1	of
App'd						2	



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

CERTIFIED FINAL
DATE: 21.10.1998 *A.T.*

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

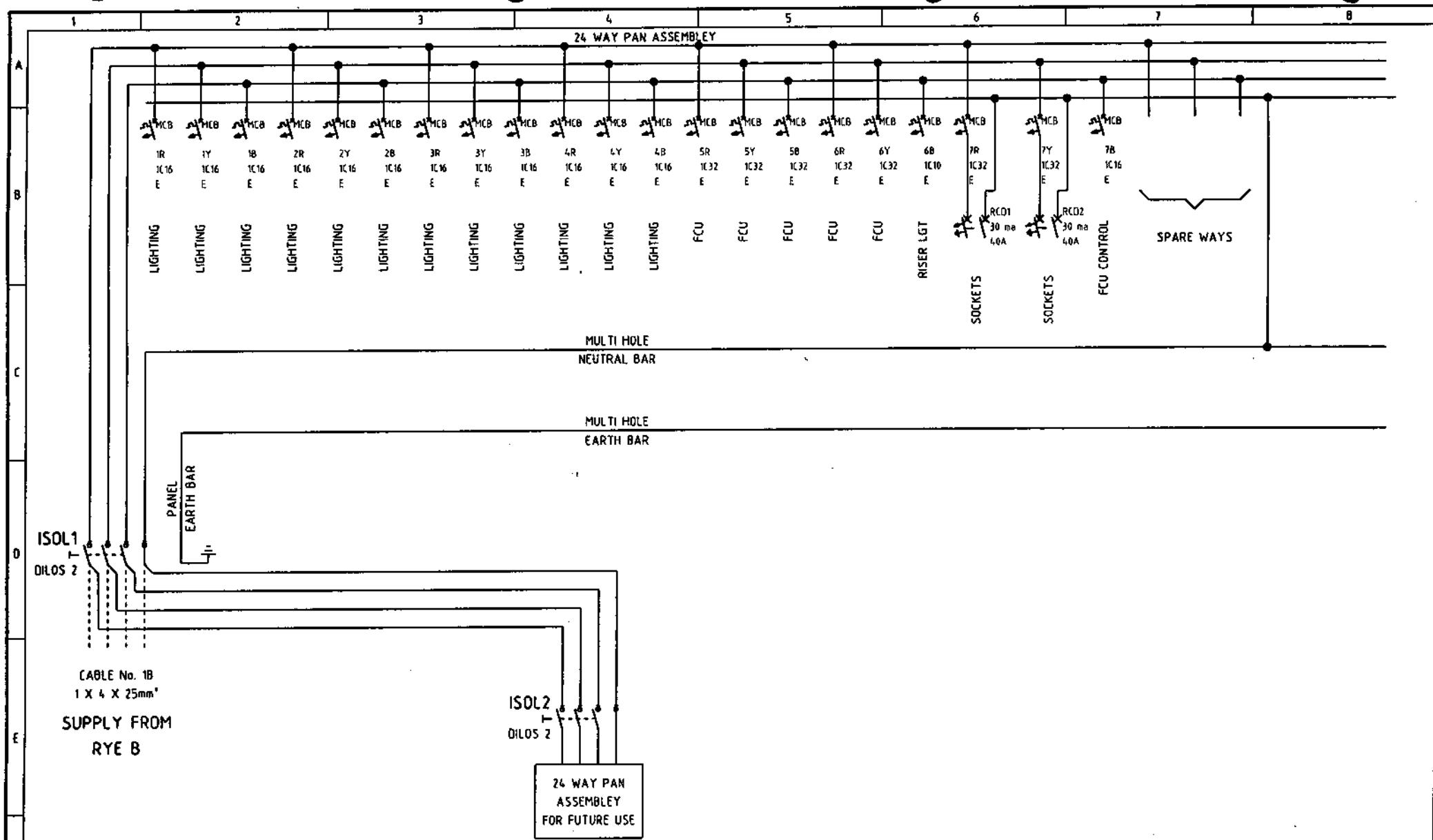
Title
DB LG/T2
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
DVE ARUP & PARTNERS

Drawing No.
558/N2/1

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Sheet 1



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DATE: 21.10.1998

A. T

DISTRIBUTION BOARD LG/T2



Project
5-7 CARLTON GARDENS
LONDON

Title
DB LG/T2
DB LG/T2 POWER SCHEMATIC

Client
T. CLARKE PLC

Consultant
OVE ARUP & PARTNERS

Drawing No.
55B/N2/2

Revision
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Sheet
2
of

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd App'd		

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032

8 WAY TP DIST BD+KEY
FUTURE USE

1ROW EXT PLAIN/KEY
06 G/T1 RCOs

8 WAY TP DIST BD+KEY
OR G/T1 DIST BOARD

1524mm

500mm

135mm

CABLE COLOURS

R PHASE = RED

S PHASE = YELLOW

T PHASE = BLUE

NEUTRAL = BLACK

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J. PREVOT

pp'd

Name _____ Date _____

A.T.



Project
5-7 CARLTON GARDENS
LONDON

08 G/T1
GENERAL ARRANGEMENT

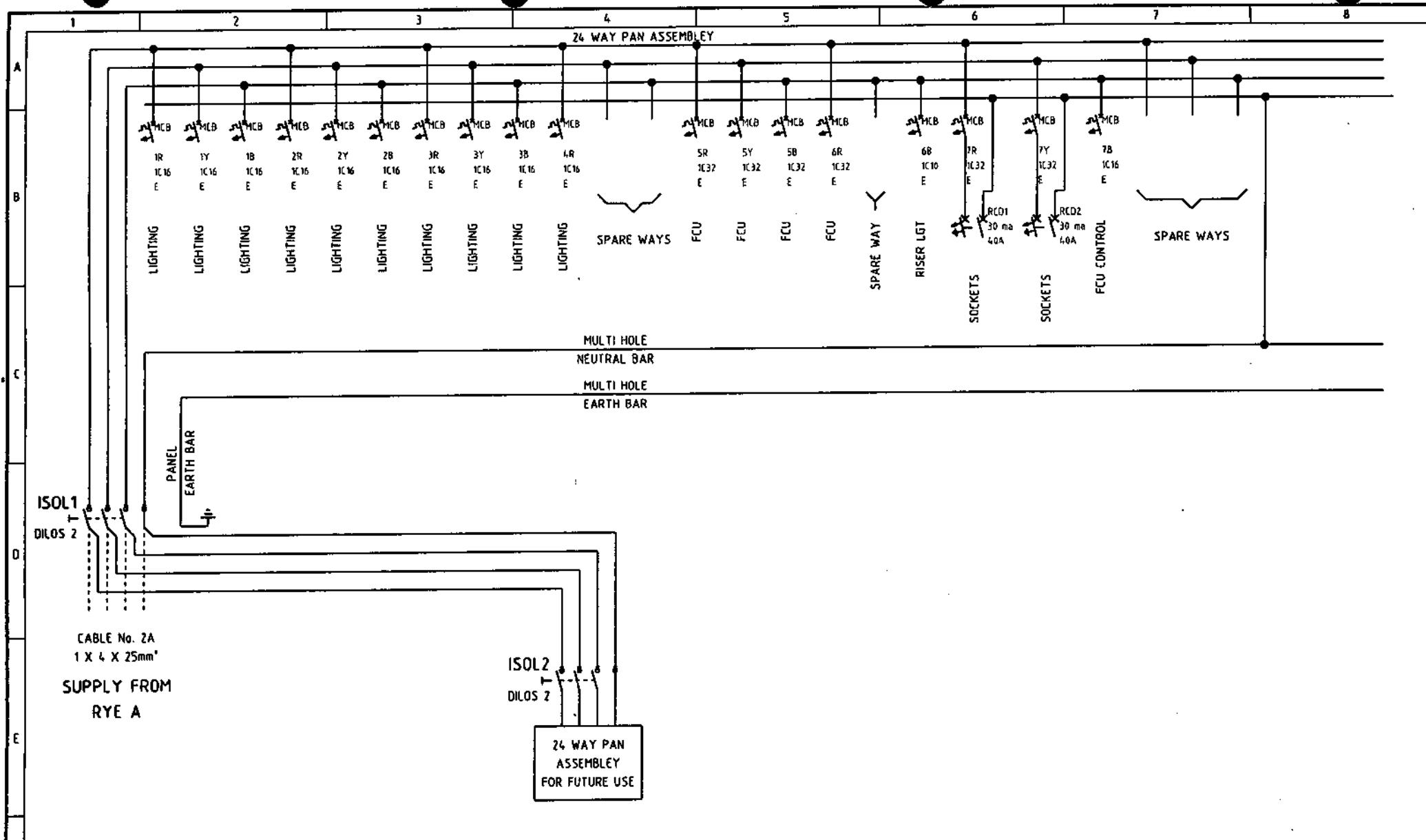
Client

CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
558/P1/

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DATE: 21.10.1998

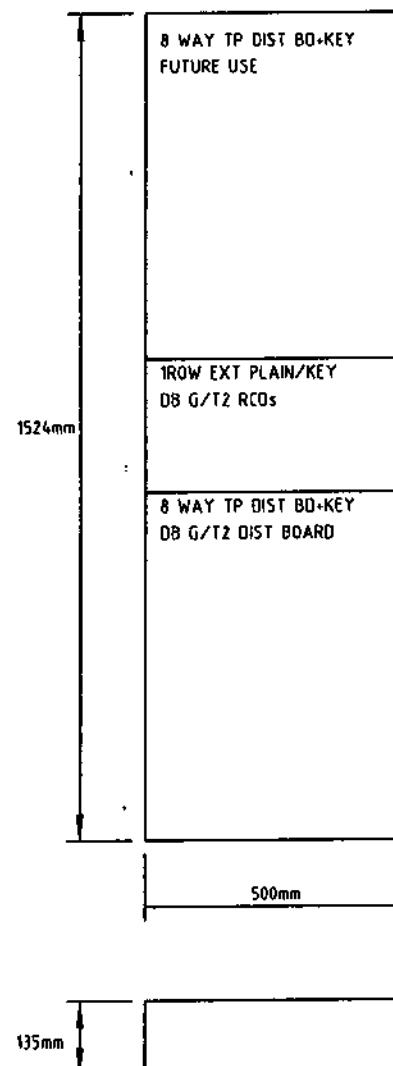
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DISTRIBUTION BOARD G/T1

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Chkd							
App'd							

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS

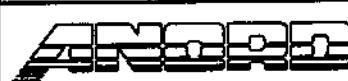
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

CERTIFIED FINAL

DATE: 21.10.1998

A-T

Name	Date
Drawn J. McEVoy	05-06-98
Chkd	
App'd	



Project
5-7 CARLTON GARDENS
LONDON

Title
DB G/T2
GENERAL ARRANGEMENT

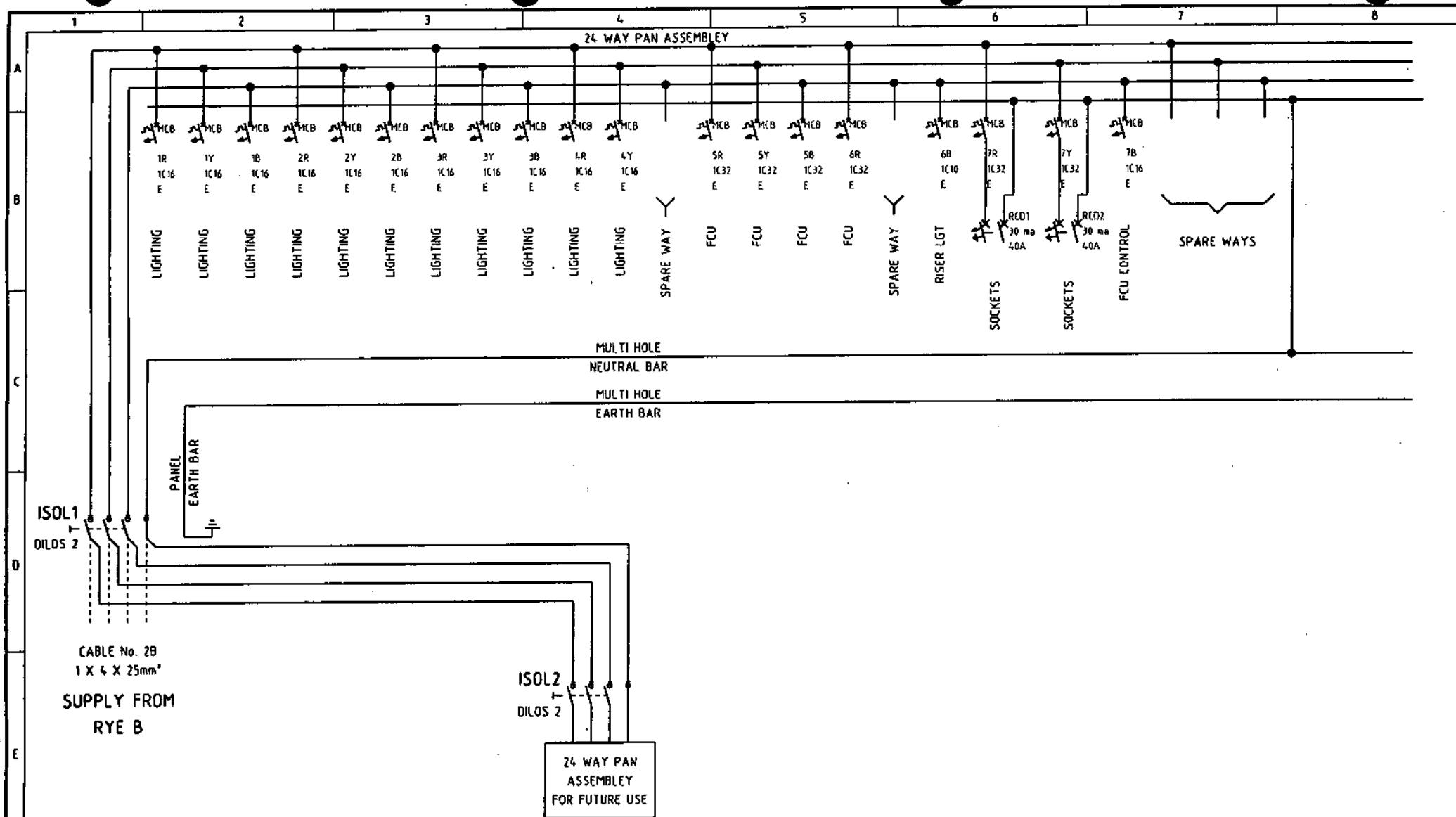
Client
T. CLARKE PLC

CONSULTANT
DOE ARUP & PARTNERS

Drawing No.
558/P2/1

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of

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DATE: 21.10.1998

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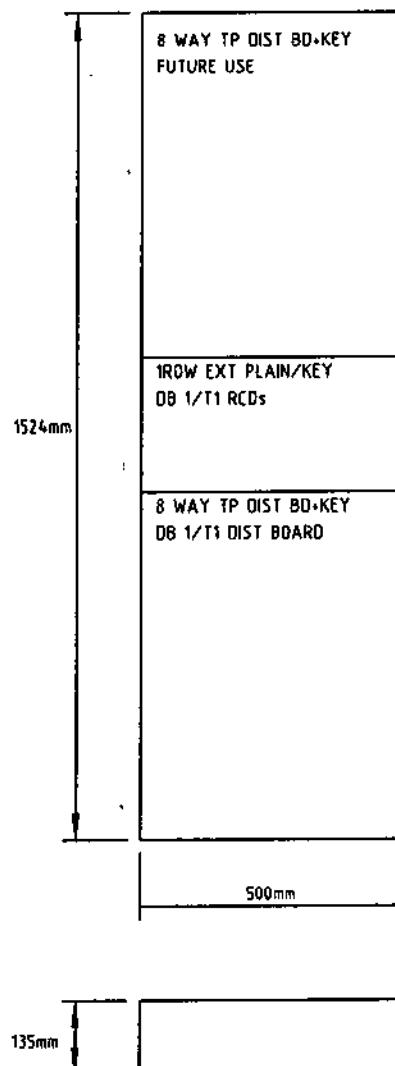
DISTRIBUTION BOARD G/T2

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On'dd:						1	of
App'd:							



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS

R PHASE = RED

S PHASE = YELLOW

T PHASE = BLUE

NEUTRAL = BLACK

F CERTIFIED FINAL

DATE: 21.10.1998

A.T

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
App'd		



Project
5-7 CARLTON GARDENS
LONDON

Title
DB 1/T1
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
DOE ARUP & PARTNERS

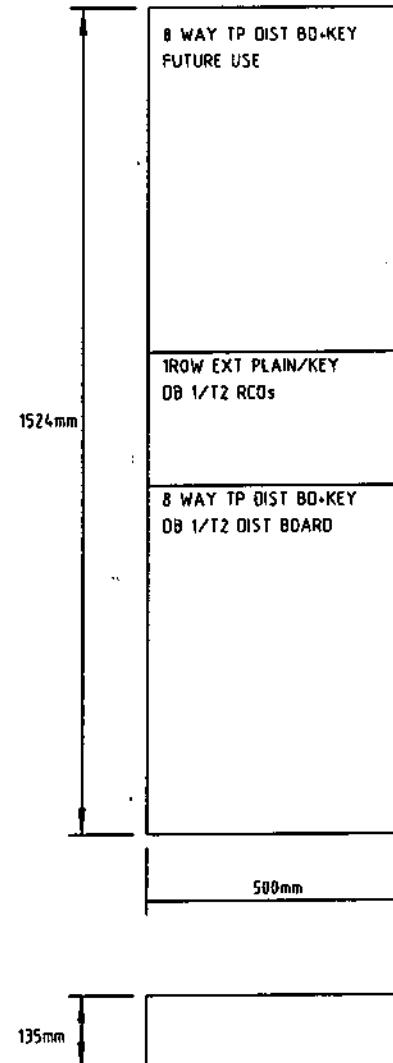
Drawing No.
558/01/1

Revision
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of

Sheet
1

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GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032

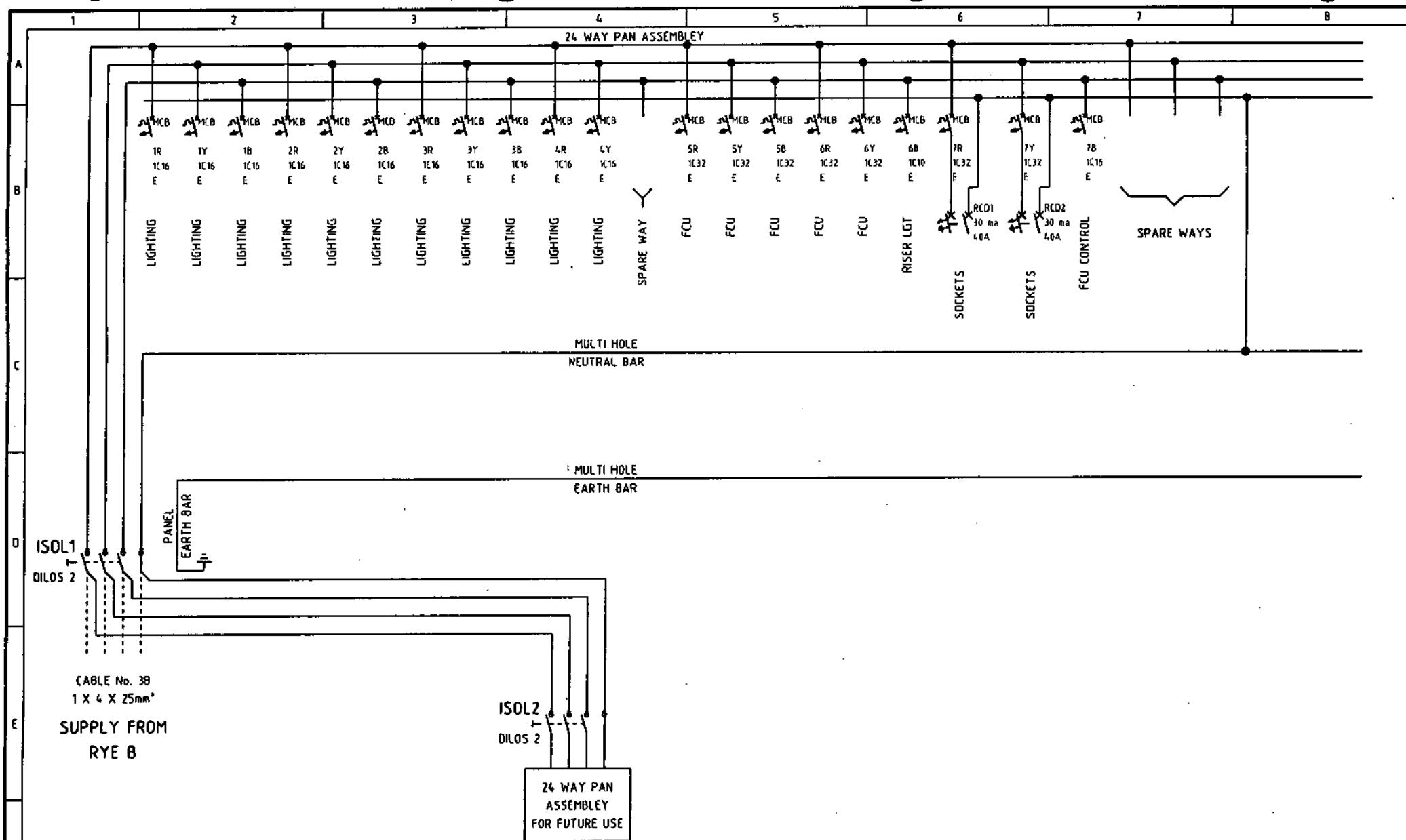


CABLE COLOURS			
R PHASE	= RED		
S PHASE	= YELLOW		
T PHASE	= BLUE		
NEUTRAL	= BLACK		

F CERTIFIED FINAL
DATE: 21.10.1998 *A. T.*

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEVoy	05-08-98	5-7 Carlton Gardens London	DB 1/T2 GENERAL ARRANGEMENT	T. CLARKE PLC	558/02/1	A	1
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App'd					1		





CERTIFIED FINAL

DATE: 21.10.1998

A.T

DISTRIBUTION BOARD 1/T2

Name	Date	
Draen J. McEvoy	05-08-98	
Chkd		
Appd		



Project
5-7 CARLTON GARDENS
LONDON

Title
DB 1/T2
DB 1/T2 POWER SCHEMATIC

Client
T. CLARKE PLC
Consultant
DVE ARUP & PARTNERS

Drawing No.
558/02/2
1
of

Revision
A
Sheet
2

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032

8 WAY TP DIST BD+KEY
FUTURE USE

1ROW EXT PLAIN/KEY
DB 2/T1 RCDs

8 WAY TP DIST BD+KEY
DB 2/T1 DIST BOARD

1524mm

500mm

135mm

CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

CERTIFIED FINAL

DATE: 21.10.1998

A.1



Project
5-7 CARLTON GARDENS
LONDON

Title
DB 2/T1
GENERAL ARRANGEMENT

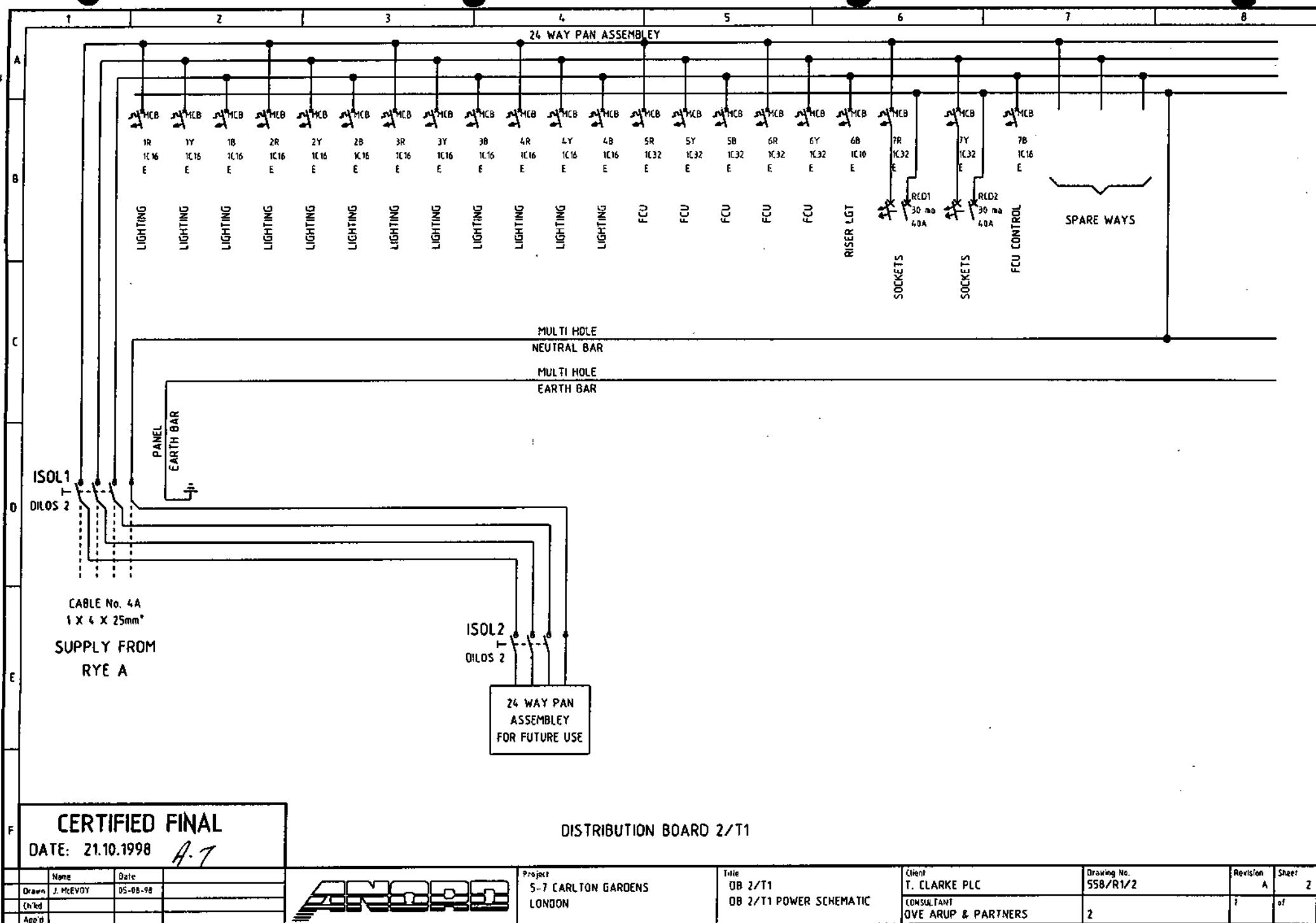
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T. CLARKE PLC

Consultant
DVE ARUP & PARTNERS

Drawing No.
558/R1/1

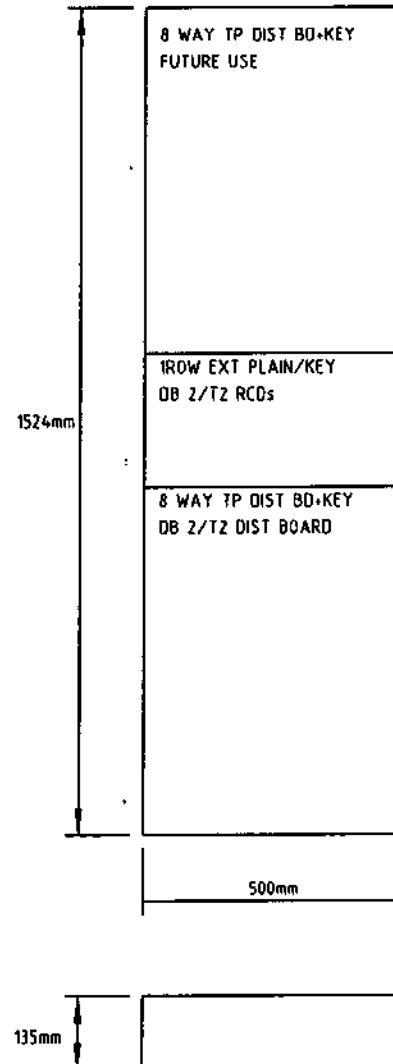
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of 1

	Name	Date	
Drawn	J. McEVoy	05-08-98	
Chkd			
App'd			



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS

R PHASE = RED

S PHASE = YELLOW

T PHASE = BLUE

NEUTRAL = BLACK

CERTIFIED FINAL

DATE: 21.10.1998

A.T

Name	Date	Chkd	App'd
J. McEVoy	05-08-98		



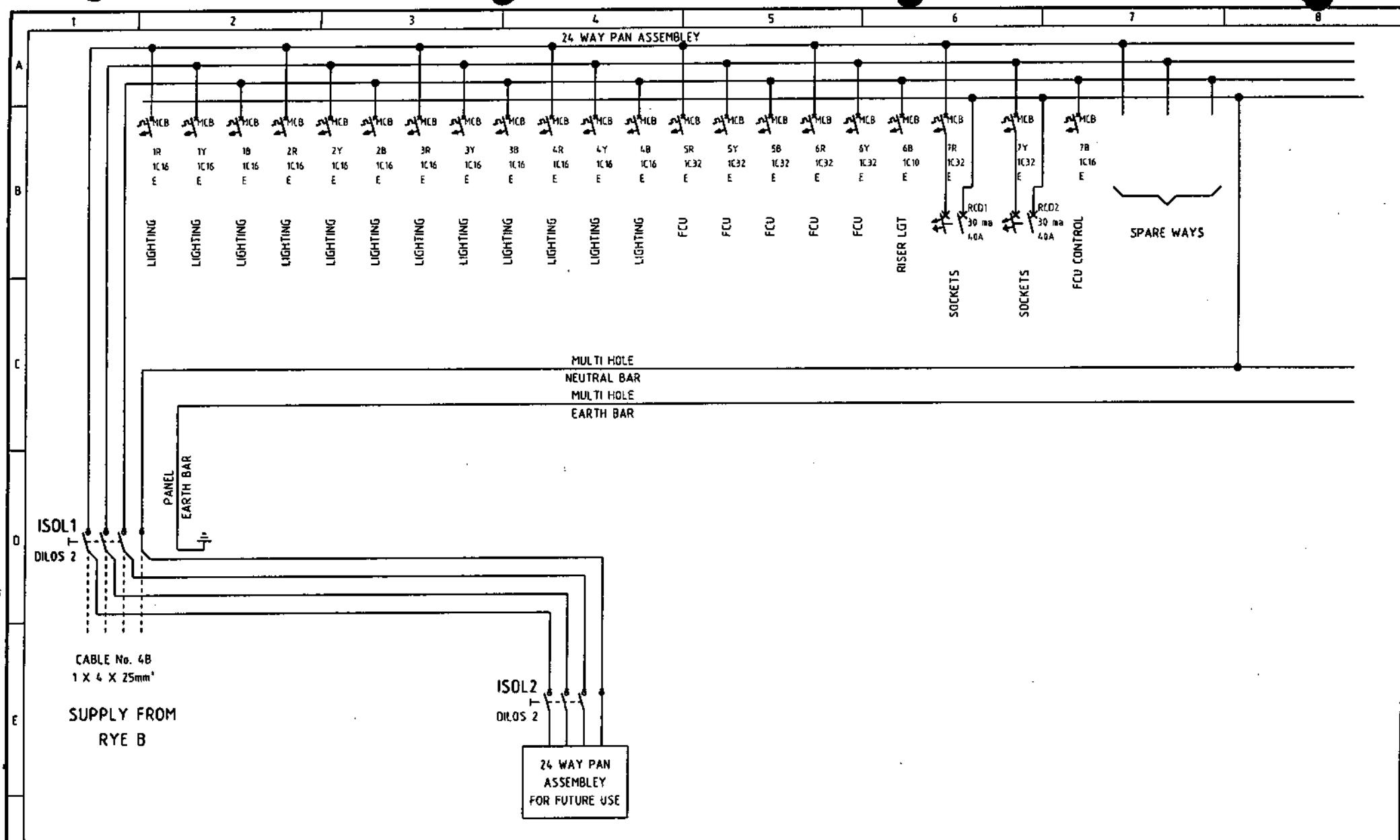
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5-7 CARLTON GARDENS
LONDON

Title
DB 2/T2
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
DVE ARUP & PARTNERS

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DATE: 21.10.1998

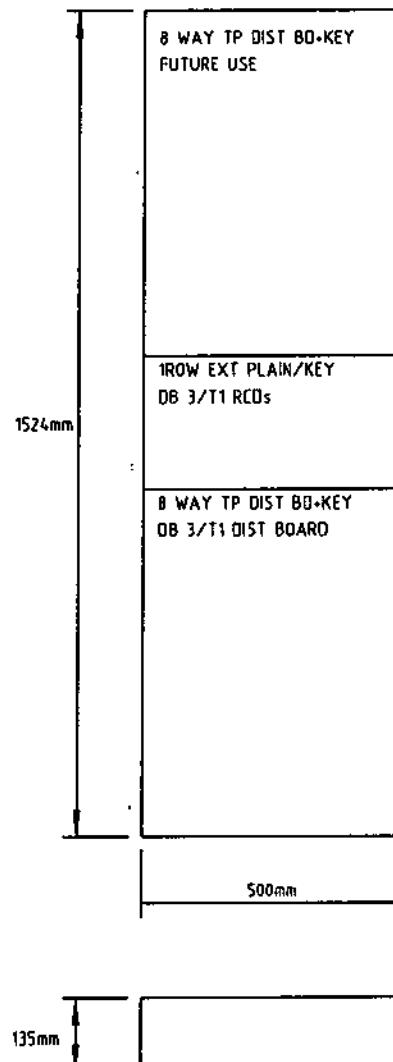
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Chkd						1	of
App'd							



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998 *A.T.*

Drawn	Name	Date	
J. McEVoy		05-08-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

Title
DB 3/T1
GENERAL ARRANGEMENT

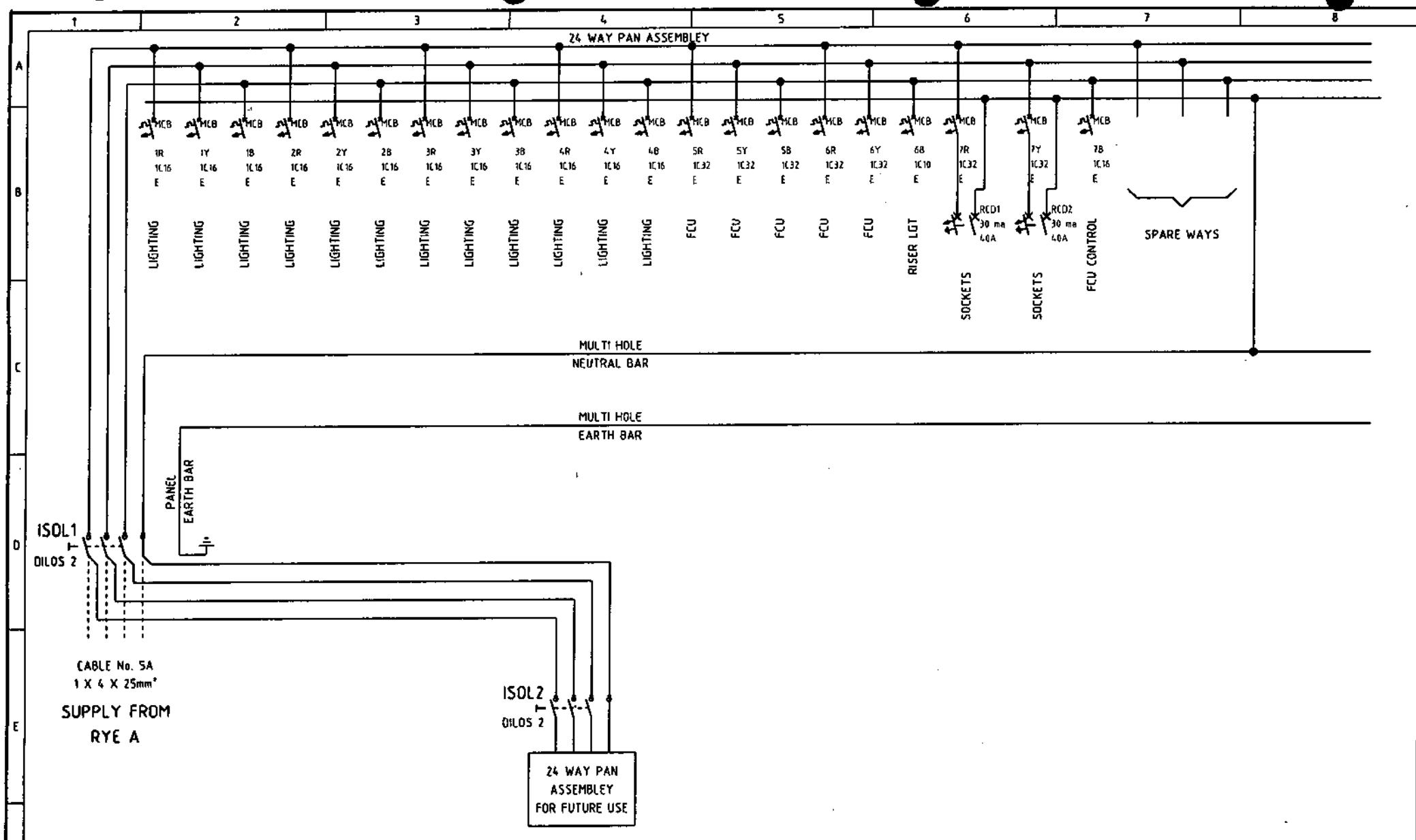
Client
T. CLARKE PLC

CONSULTANT
AVE ARUP & PARTNERS

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DATE: 21.10.1998

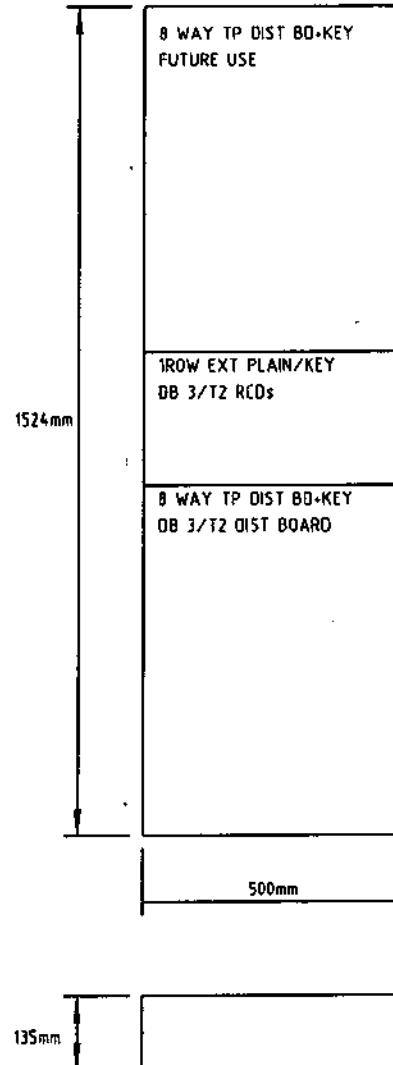
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Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEVoy	05-08-98	5-7 CARLTON GARDENS LONDON	DB 3/T1 DB 3/T1 POWER SCHEMATIC	T. CLARKE PLC CONSULTANT OVE ARUP & PARTNERS	SSB/S1/2	A	2
Chkd						1	of
App'd					2		



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998 *A.T.*

	Name	Date	
Drawn	J. McLEVOY	05-08-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

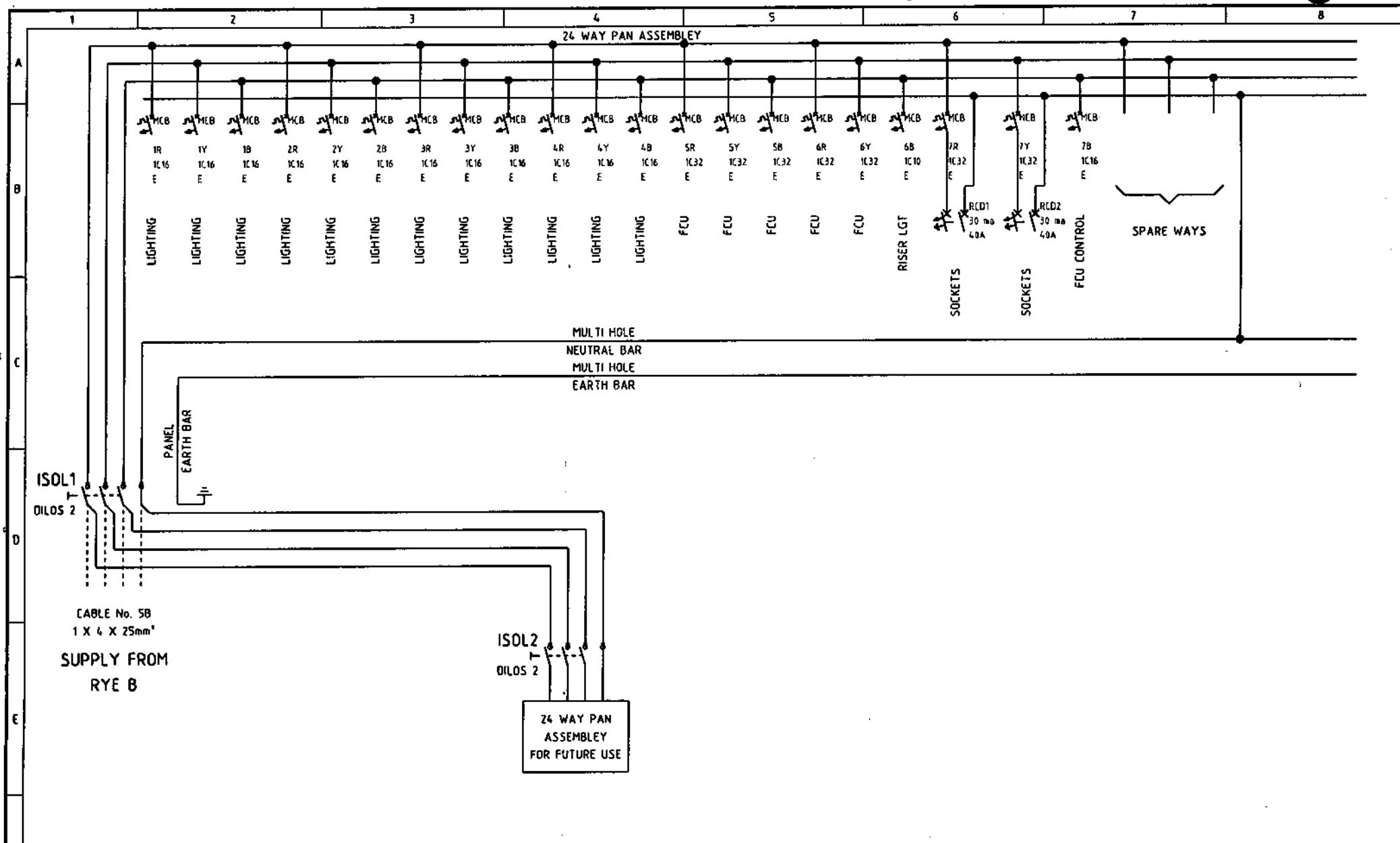
Title
DB 3/T2
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
OVE ARUP & PARTNERS

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558/S2/1

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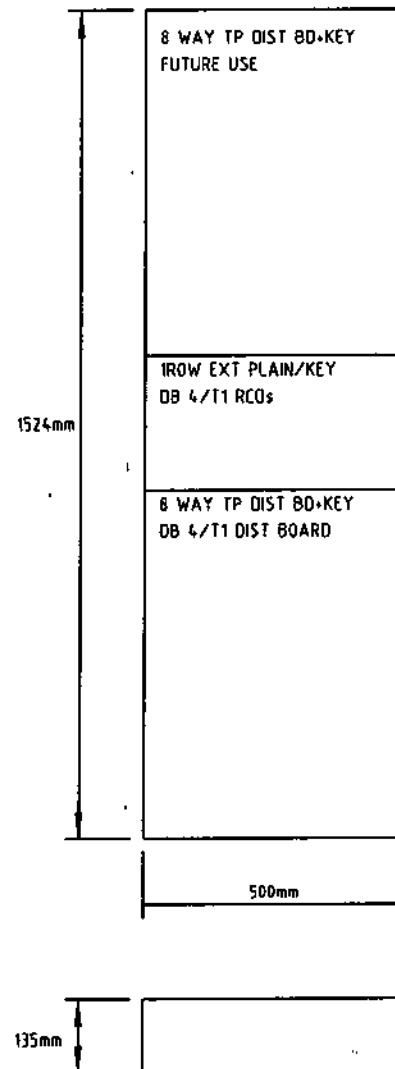
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DISTRIBUTION BOARD 3/T2

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
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Chkd						1	of
App'd						2	

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998 A.T

	Name	Date	
Drawn	J. McEVYD	05-08-98	
Ch'td			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

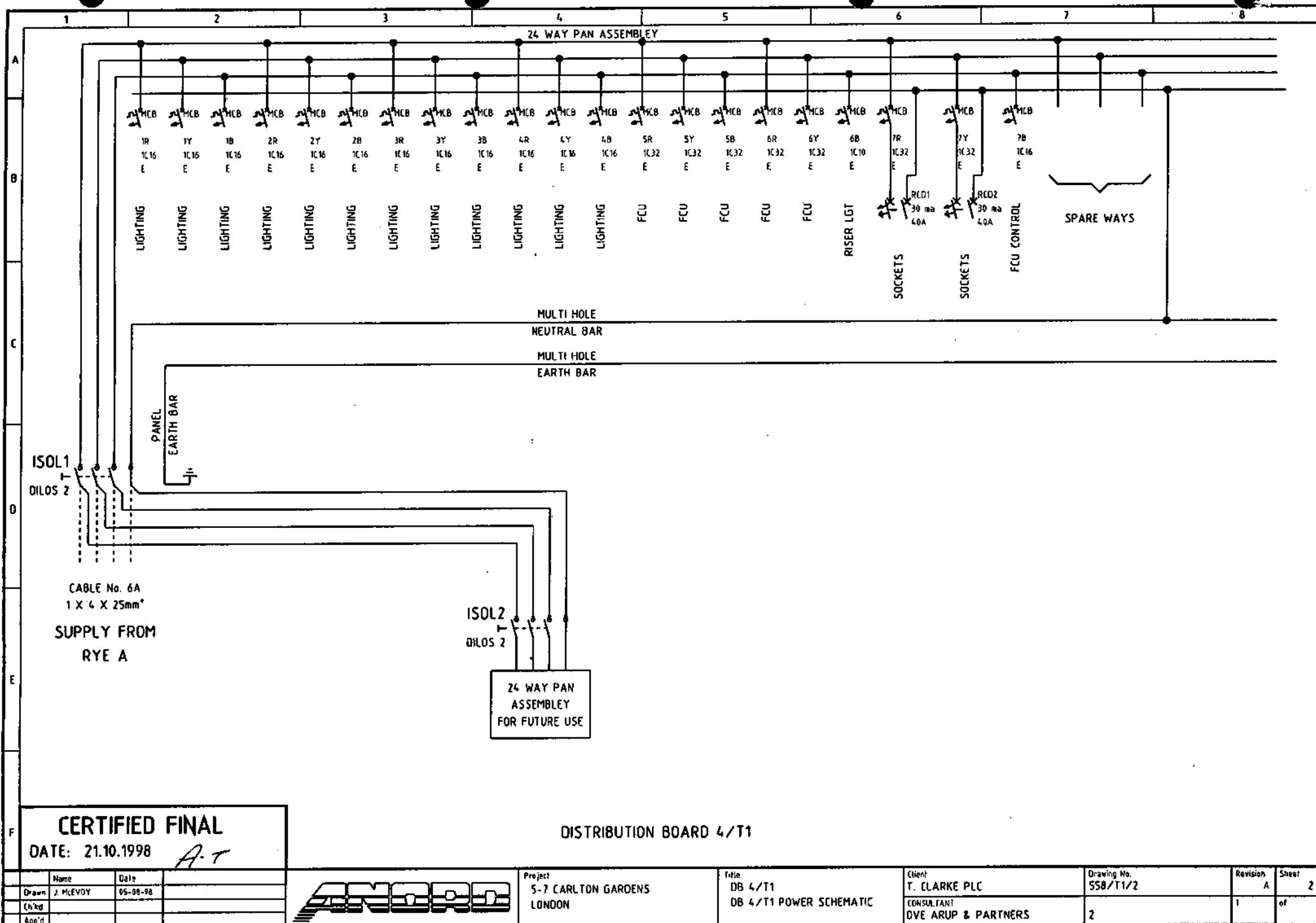
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DB 4/T1
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
OVE ARUP & PARTNERS

Drawing No.
558/T1/1

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1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032

B WAY TP DIST BD+KEY
FUTURE USE

1ROW EXT PLAIN/KEY
DB 4/T2 RCDs

B WAY TP DIST BD+KEY
DB 4/T2 DIST BOARD

1524mm

500mm

135mm

CABLE COLOURS

R PHASE = RED

S PHASE = YELLOW

T PHASE = BLUE

NEUTRAL = BLACK

CERTIFIED FINAL

DATE: 21.10.1998

A-7

	Name	Date	
Drawn	J. McEVOLY	05-08-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

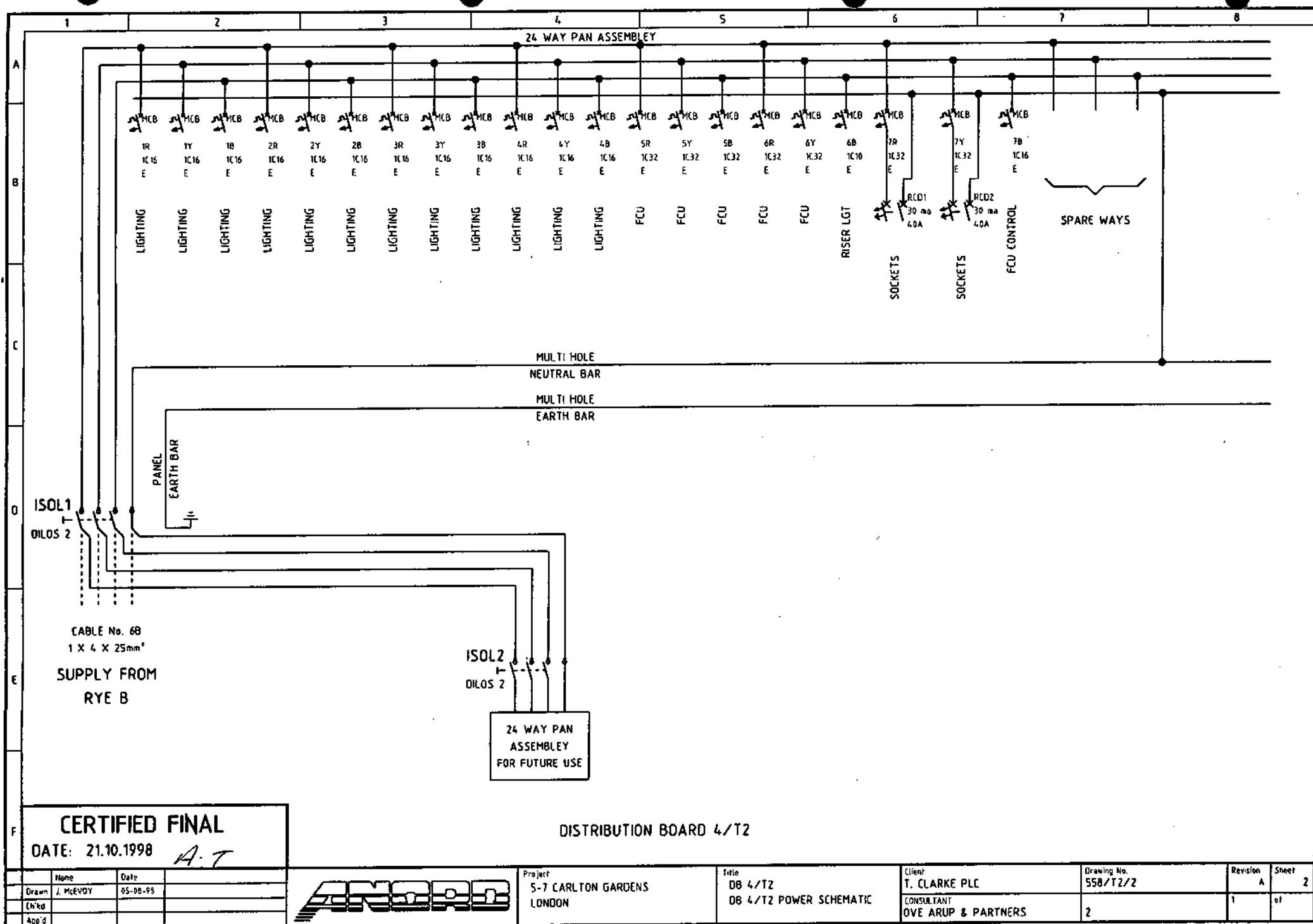
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GENERAL ARRANGEMENT

Client
T. CLARKE PLC

Consultant
DVE ARUP & PARTNERS

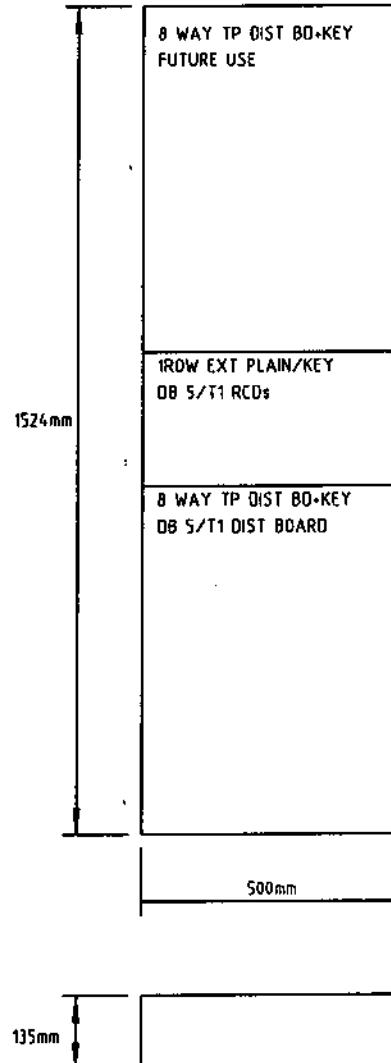
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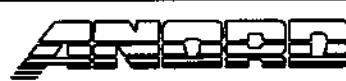
GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

F CERTIFIED FINAL
DATE: 21.10.1998 A.T.

Name	Date
Drawn J. McEVoy	05-09-98
Chkd	
App'd	



Project
S-7 CARLTON GARDENS
LONDON

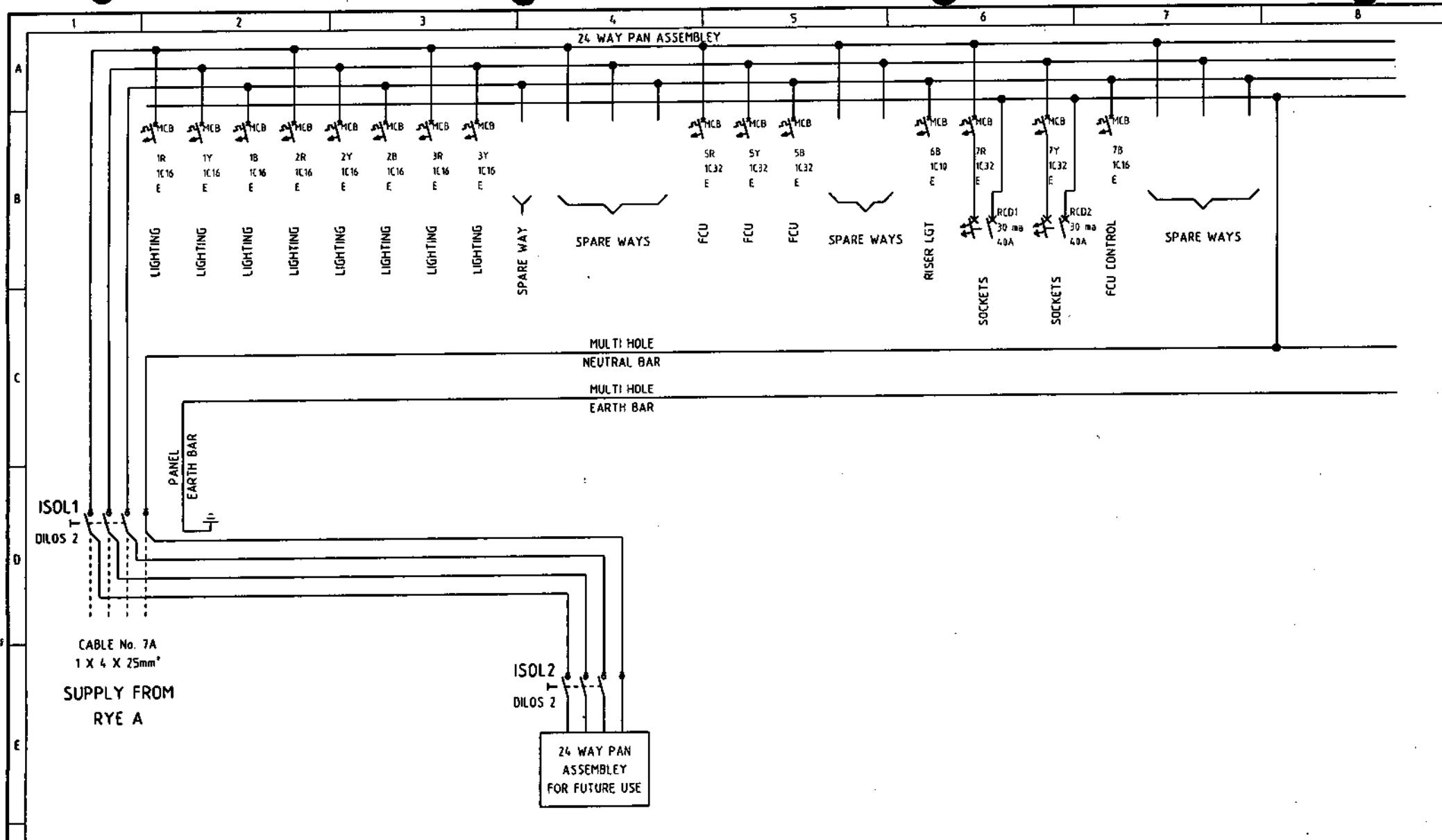
Type
DB S/T1
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
558/U1/1

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of



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DATE: 21.10.1998

A-7

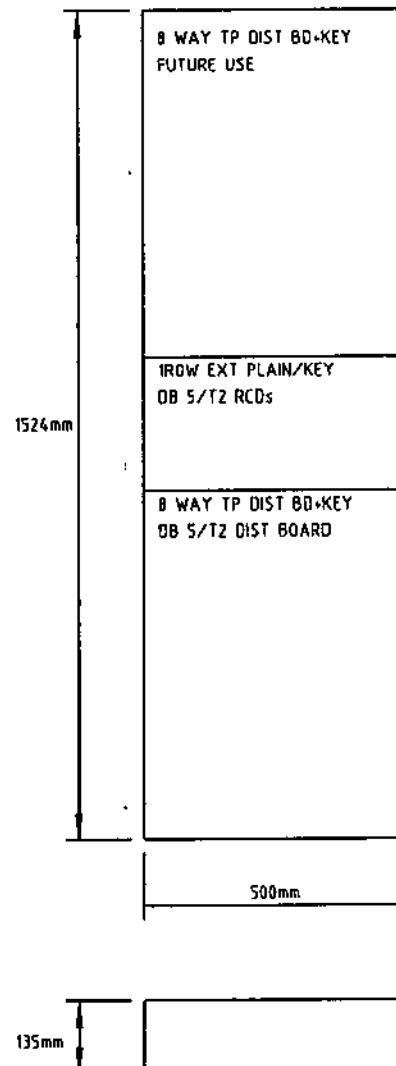
DISTRIBUTION BOARD 5/T1

Name	Date	Drawn	Project	Title	Client	Drawing No.	Revision	Sheet
J. McEVoy	05-08-98		5-7 CARLTON GARDENS LONDON	DB 5/T1 DB 5/T1 POWER SCHEMATIC	T. CLARKE PLC CONSULTANT DVE ARUP & PARTNERS	558/U1/2	A	2
Chkd							1	of
App'd								



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

CERTIFIED FINAL

DATE: 21.10.1998

A.T

	Name	Date	
Drawn	J. McKEVOY	05-08-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

Title
DB 5/T2
GENERAL ARRANGEMENT

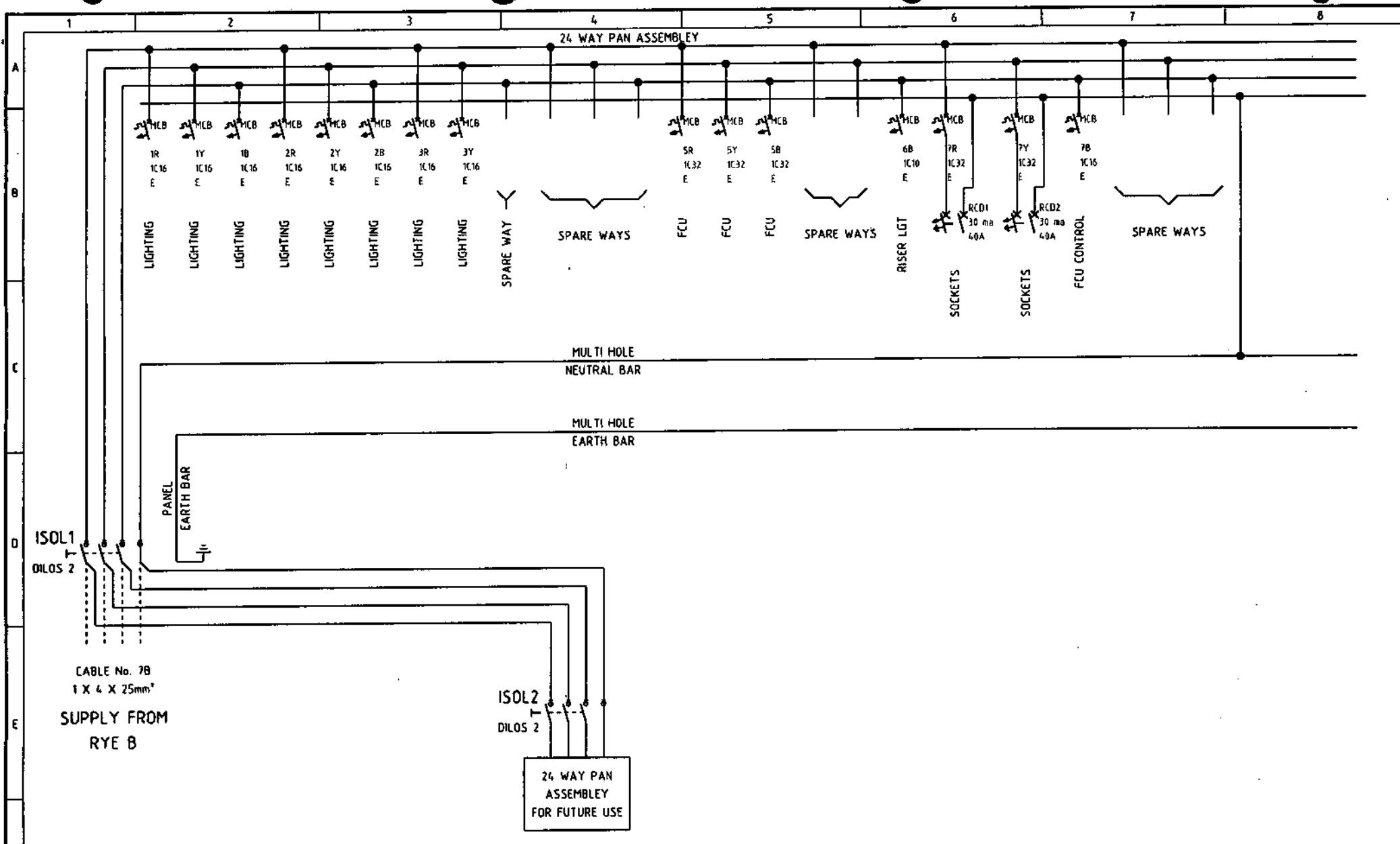
Client
T. CLARKE PLC

CONSULTANT
DOE ARUP & PARTNERS

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CERTIFIED FINAL

DATE: 21.10.1998

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DISTRIBUTION BOARD S/T2



Project:
5-7 CARLTON GARDENS
LONDON

Title:
DB S/T2
DB S/T2 POWER SCHEMATIC

Client:
T. CLARKE PLC

Consultant:
DOE ARUP & PARTNERS

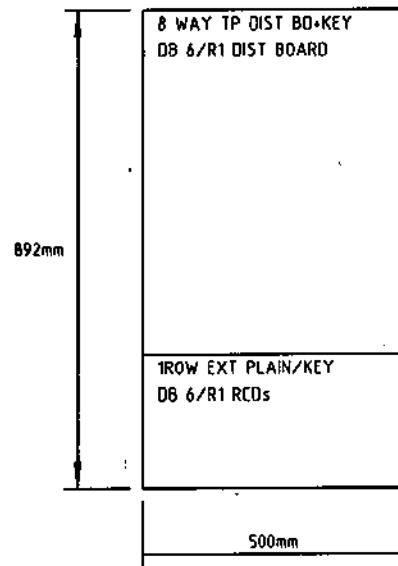
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55B/U2/2

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Sheet 2
of

Name	Date	
J. McEVNEY	05-08-98	
Chkd		
App'd		

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS

R PHASE = RED

S PHASE = YELLOW

T PHASE = BLUE

NEUTRAL = BLACK



CERTIFIED FINAL

DATE: 21.10.1998

A.7

Name	Date	
Drawn J. McEVoy	05-08-98	
Chkd		
Appd		



Project
5-7 CARLTON GARDENS
LONDON

Title
DB 6/R2
GENERAL ARRANGEMENT

Client
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

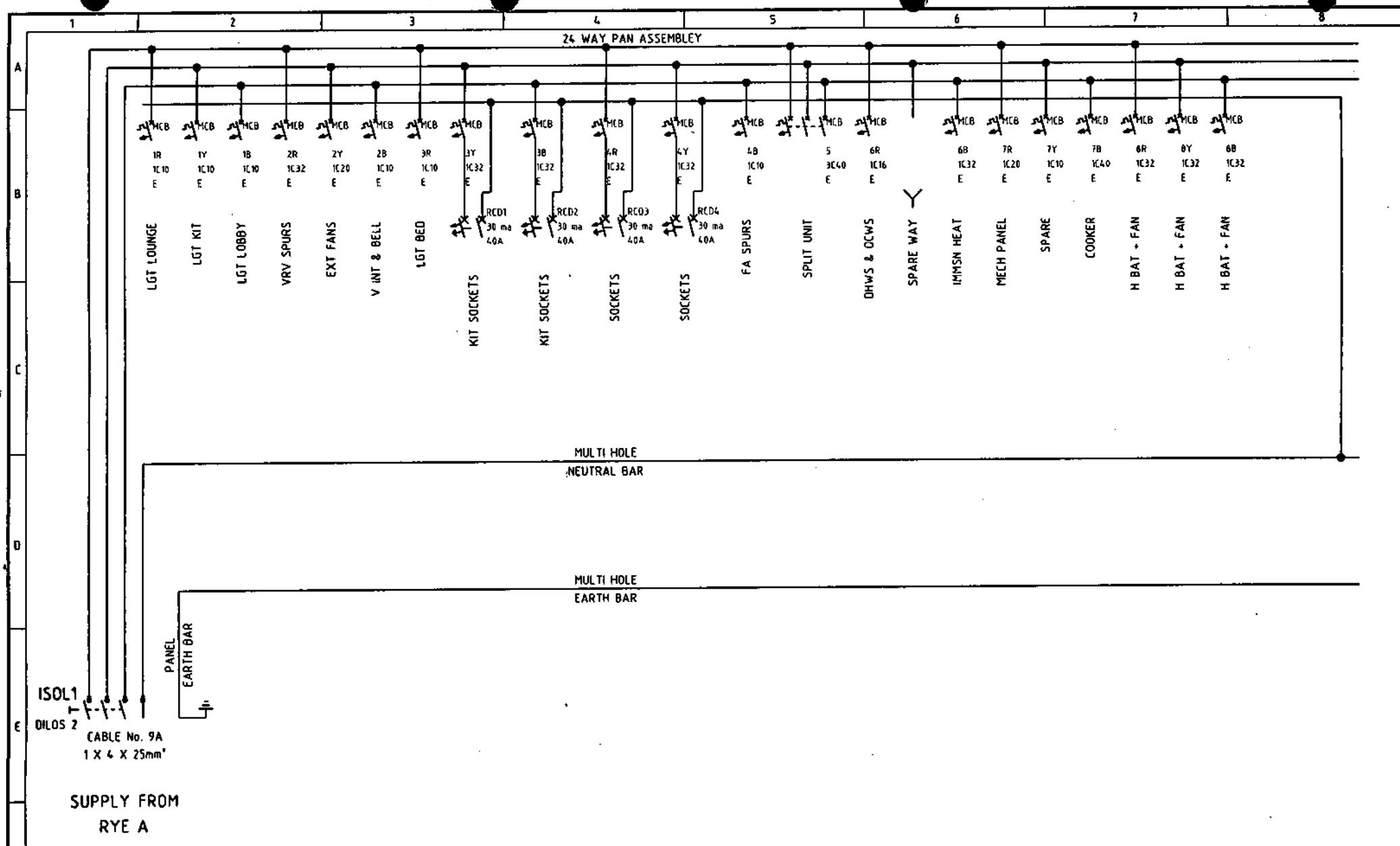
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24 WAY PAN ASSEMBLY



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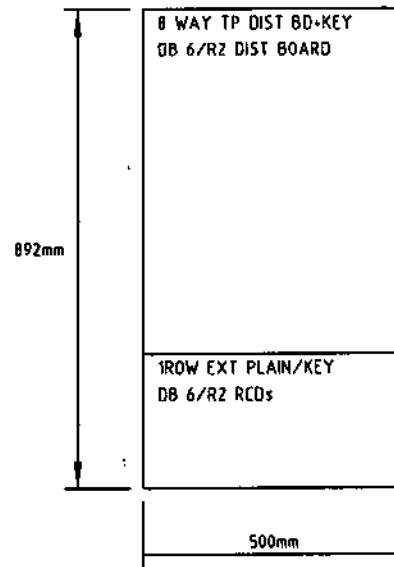
DATE: 21.10.1998 *A.7*

DISTRIBUTION BOARD 6/R2

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEVoy	05-09-99	5-7 CARLTON GARDENS LONDON	DB 6/R2 DB 6/R2 POWER SCHEMATIC	T. CLARKE PLC CONSULTANT OVE ARUP & PARTNERS	558/V1/2	A	2
Chkd						1	of
App'd						2	

1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

CERTIFIED FINAL

DATE: 21.10.1998

A.7

	Name	Date	
Drawn	J. McEVoy	05-08-98	
Chkd			
App'd			



Project
5-7 CARLTON GARDENS
LONDON

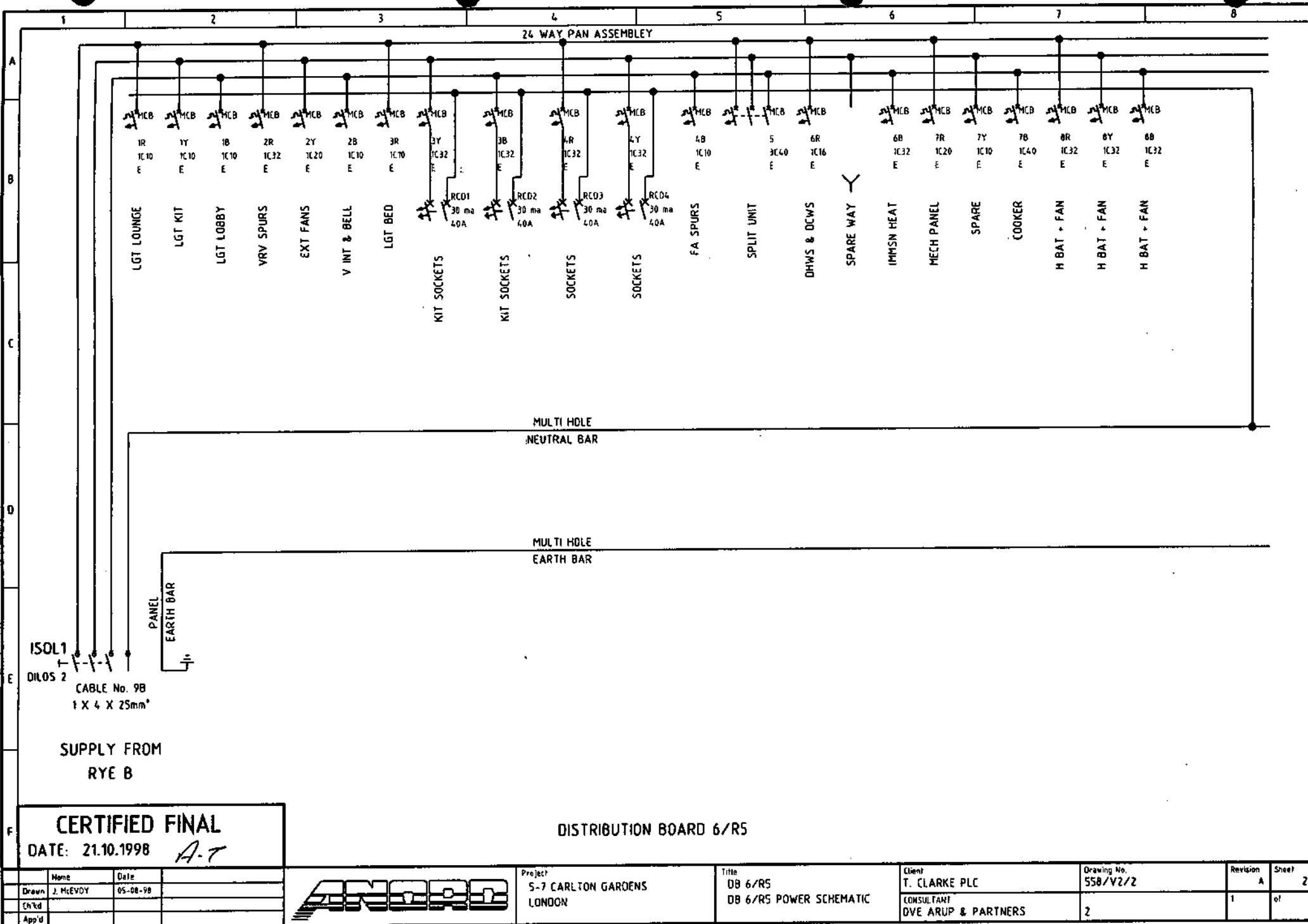
Title
DB 6/RS
GENERAL ARRANGEMENT

Client
T. CLARKE PLC
CONSULTANT
DOE ARUP & PARTNERS

Drawing No.
558/V2/1
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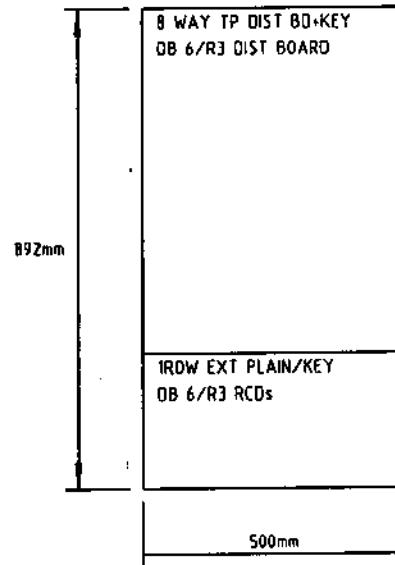
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of



1 2 3 4 5 6 7 8

GE PANEL BOARD 16KA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E

CABLE COLOURS

R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK



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CERTIFIED FINAL
DATE: 21.10.1998 A.T.

Name	Date
Drawn J. McEVoy	05-08-98
Chkd	
App'd	



Project:
5-7 CARLTON GARDENS
LONDON

Title:
DB 6/R6
GENERAL ARRANGEMENT

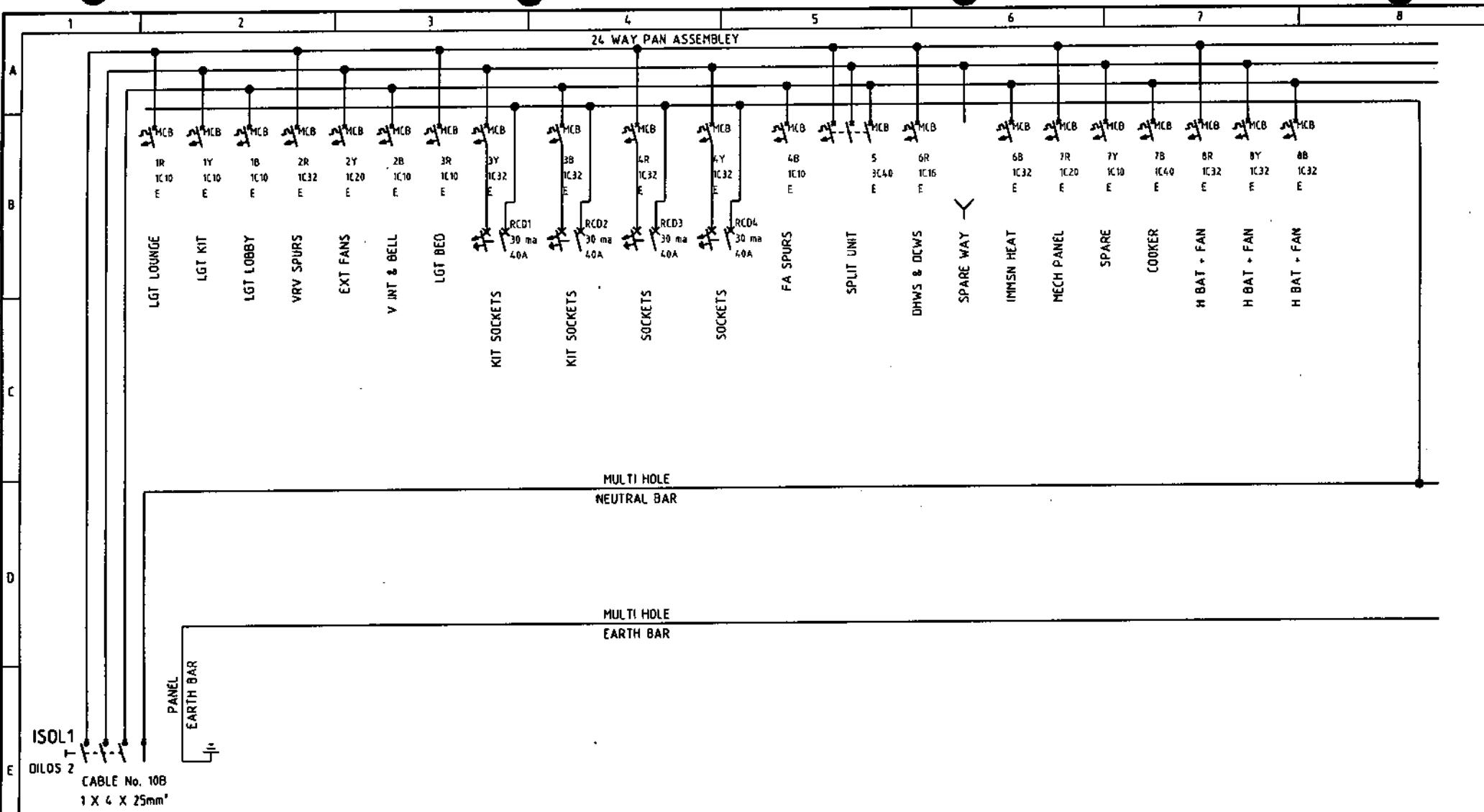
Client:
T. CLARKE PLC

CONSULTANT
OVE ARUP & PARTNERS

Drawing No.
558/V3/1

1

Revision
A
of
1



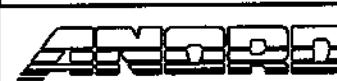
CERTIFIED FINAL

DATE: 21.10.1998

A. T

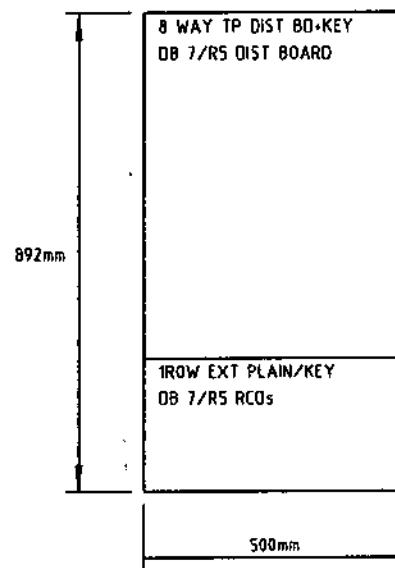
DISTRIBUTION BOARD 6/R6

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEVoy	05-08-98	5-7 CARLTON GARDENS LONDON	DB 6/R6 DB 6/R6 POWER SCHEMATIC	T. CLARKE PLC CONSULTANT DVE ARUP & PARTNERS	SS8/V3/2	A	2
Chkd						1	of
Appd					2		



1 2 3 4 5 6 7 8

GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



E CABLE COLOURS
R PHASE = RED
S PHASE = YELLOW
T PHASE = BLUE
NEUTRAL = BLACK

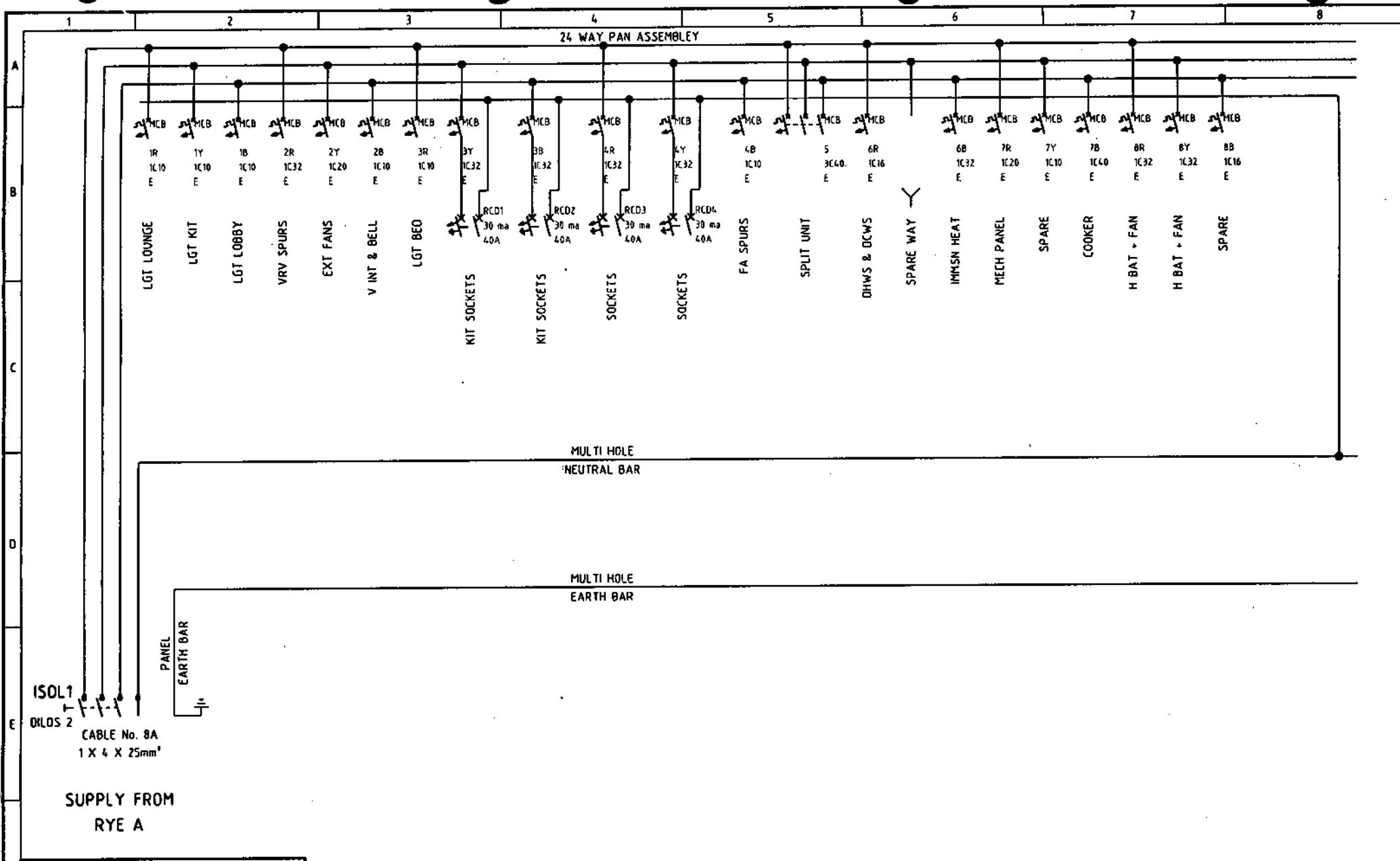
F CERTIFIED FINAL

DATE: 21.10.1998

A-T

Name	Date	Project	Title	Client	Drawing No.	Revision A	Sheet
Drawn J. McEVoy	05-08-98	5-7 CARLTON GARDENS LONDON	DB 7/R1 GENERAL ARRANGEMENT	T. CLARKE PLC	S58/W1/1		1
Enkd				CONSULTANT OVE ARUP & PARTNERS			of
App'd					1		





CERTIFIED FINAL

DATE: 21.10.1998

A.T

DISTRIBUTION BOARD 7/R1

Name	Date	Project	Title	Client	Drawing No.	Revision	Sheet
Drawn J. McEvoy	05-08-98	5-7 CARLTON GARDENS LONDON	DB 7/R1	T. CLARKE PLC	558/W1/2	A	2
Chkd			DB 7/R1 POWER SCHEMATIC	CONSULTANT OVE ARUP & PARTNERS			ef
App'd					2		



1

3

4

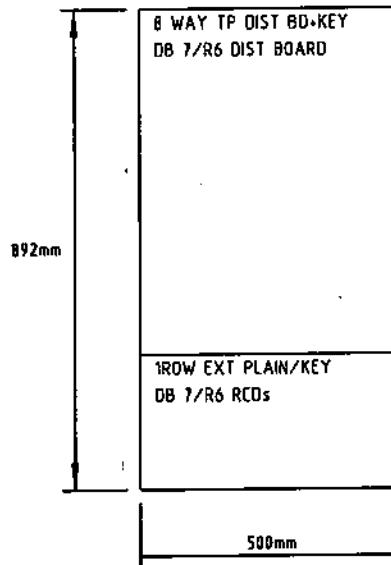
5

6

7

8

GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



A

B

C

D

E

CABLE COLOURS

R PHASE = RED

S PHASE = YELLOW

T PHASE = BLUE

NEUTRAL = BLACK

F

CERTIFIED FINAL

DATE: 21.10.1998

A-T

135mm



Project
5-7 CARLTON GARDENS
LONDON

Title
DB 7/R3
GENERAL ARRANGEMENT

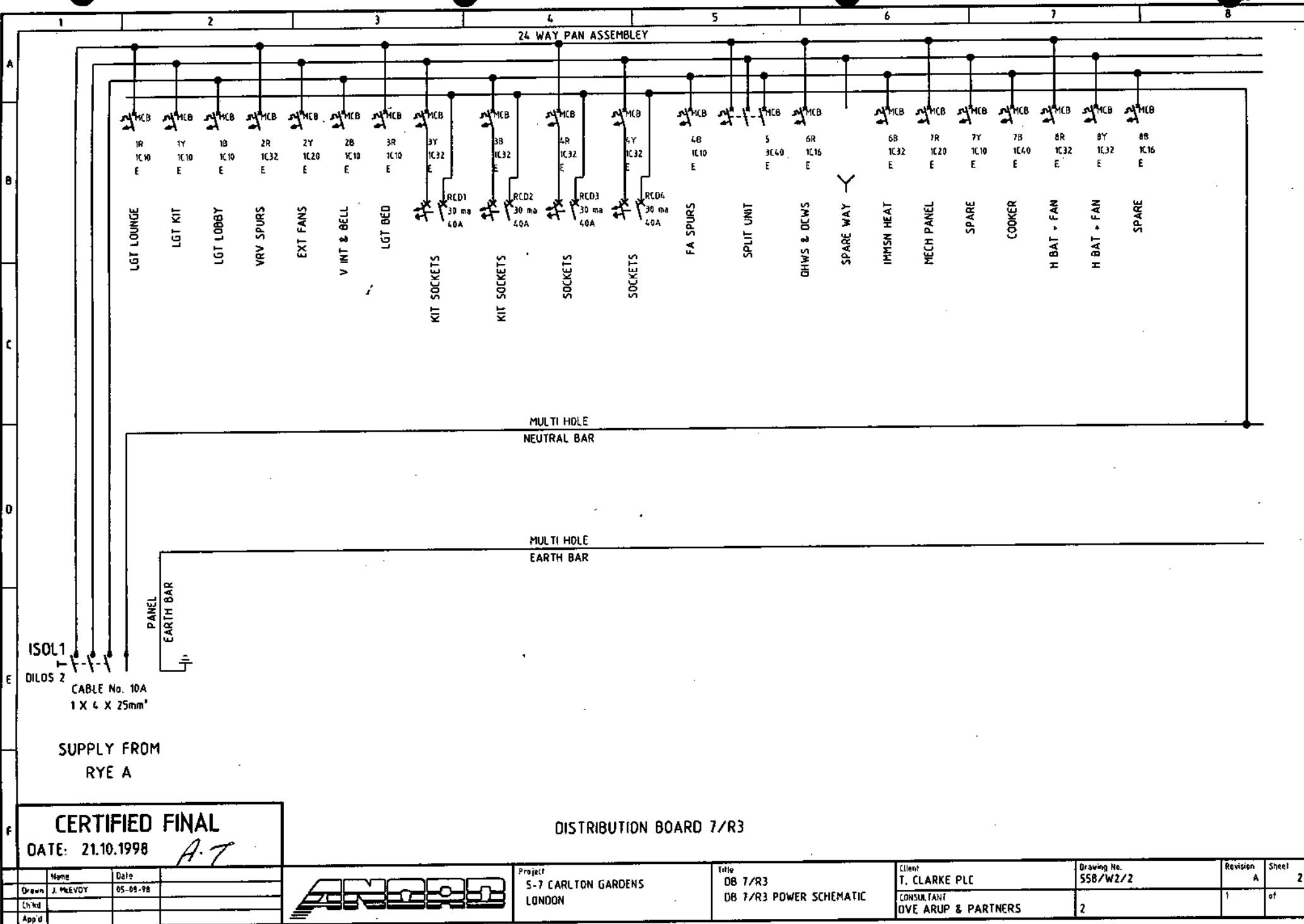
Client
T. CLARKE PLC

CONSULTANT
DVE ARUP & PARTNERS

Drawing No.
558/W2/1

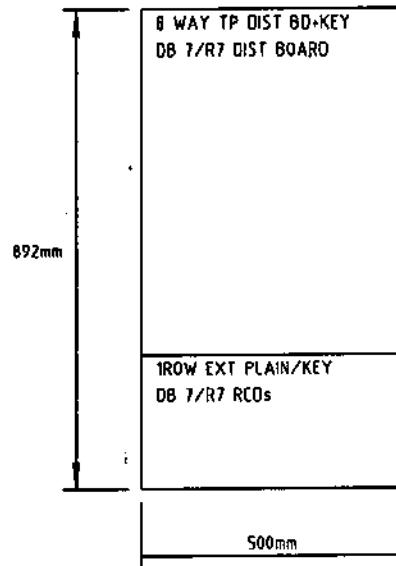
Revision
A
Sheet
1
of

	Name	Date	
Drawn	J. McEVoy	BS-08-98	
Chkd			
App'd			



1 2 3 4 5 6 7 8

GE PANEL BOARD 16kA 200A
WALL MOUNTING
COLOUR GREY RAL 7032



CABLE COLOURS			
R PHASE	= RED		
S PHASE	= YELLOW		
T PHASE	= BLUE		
NEUTRAL	= BLACK		

F CERTIFIED FINAL
DATE: 21.10.1998 A.T.

Name	Date	
Drawn	J. McEVoy	05-08-98
Chkd		
App'd		



135mm

Project
5-7 CARLTON GARDENS
LONDON

Title
DB 7/R4
GENERAL ARRANGEMENT

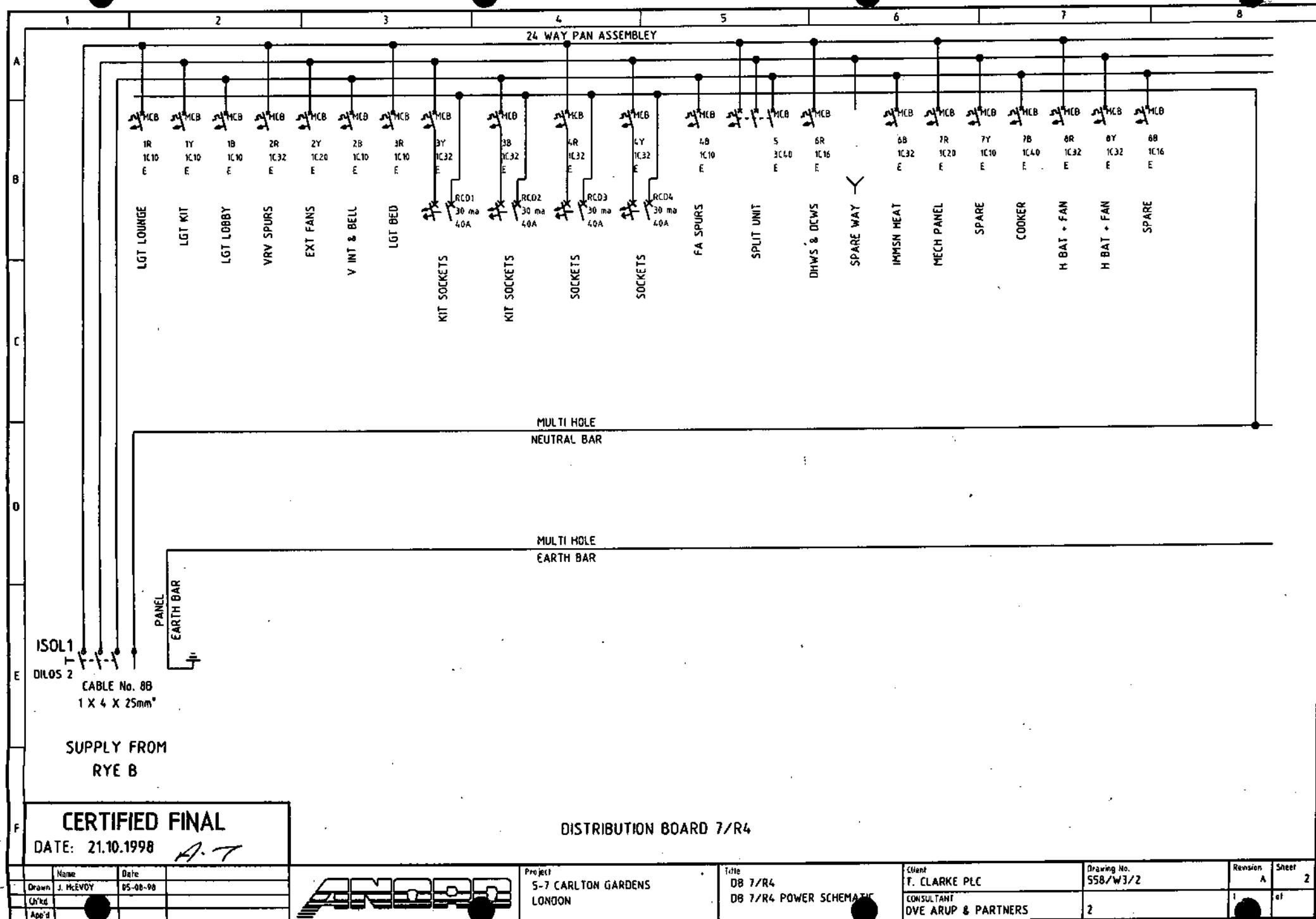
Client
T. CLARKE PLC

CONSULTANT
DOE ARUP & PARTNERS

Drawing No.
558/W3/1

Revision
A

Sheet
1
of

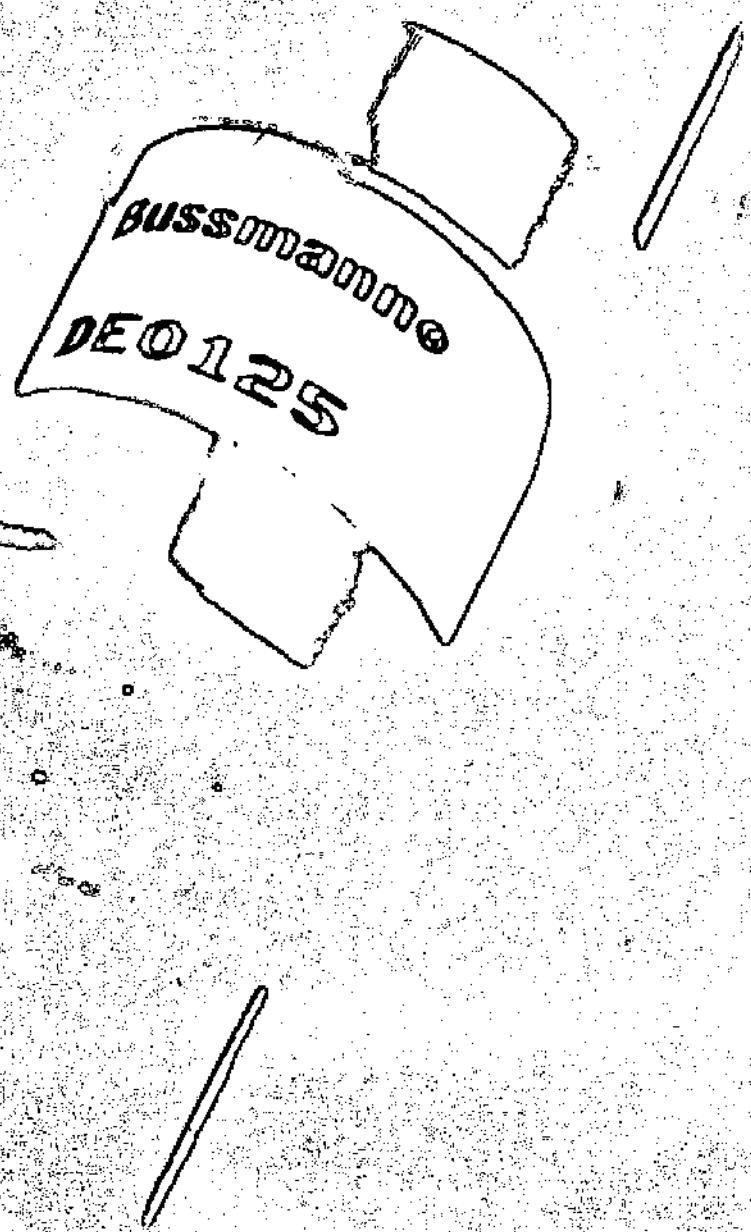


A	BUSSMANN
B	ELECTRONICON
C	BRETER
D	APEX
E	DOLD
F	ENTRELEC
G	DF
HI	GE
JK	
L	
M	
N	
O	
PQ	
R	
S	
T	
UV	

A

Bussmann

LOW VOLTAGE FUSE LINKS





WORLD-WIDE CIRCUIT PROTECTION SOLUTIONS

Bussmann manufacture a wide range of products for the protection of electrical and electronic circuits....Fuse Links, Fuse Holders, and Fusegear, all readily available from manufacturing sites in the United Kingdom, Denmark, United States, Brazil and Mexico.

Bussmann is a division of Cooper Industries Inc.,

a diversified world-wide manufacturer of electrical products and power equipment.

Bussmann has grown through both organic growth and acquisition.

Acquisitions have included the fusegear division of Lauritz Knudsen (LK-NES), Beswick which added UK Domestic fuses as well as IEC and UL Electronic fuses, Hawker Fusegear (*formally Brush Fusegear Ltd*) which strengthened our range of power fuses and Fusegear.

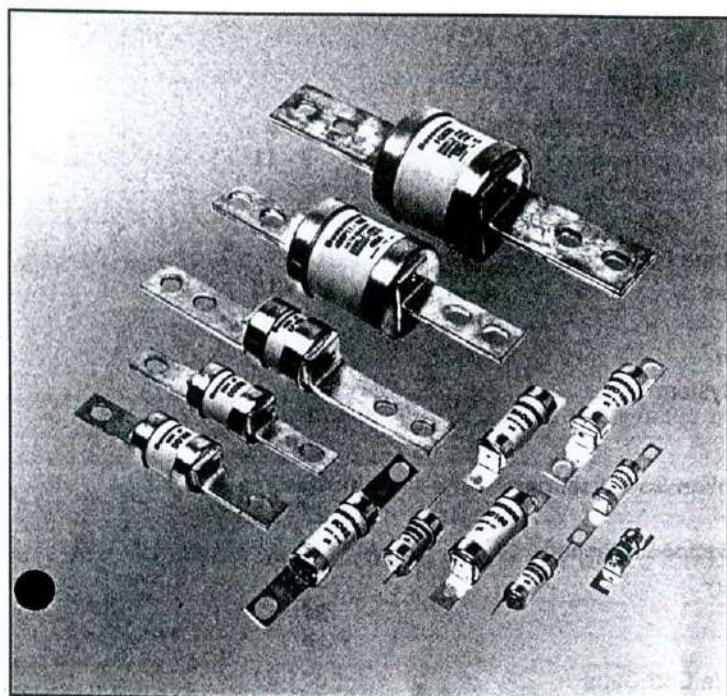
Bussmann circuit protection solutions comply with major international standards: BS, IEC, DIN and UL, CSA....Our manufacturing operations have earned ISO 9000 certification, ensuring the utmost quality across every product.

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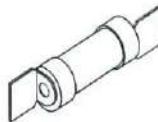
Useful Telephone Numbers.

Burton Product Sales (Low Voltage)	Tel: +44 (0)1509 882600 Fax: +44 (0)1509 882786
Export Orders (Low Voltage)	Tel: +44 (0)1509 882700 Fax: +44 (0)1509 882789
Applications Engineers	Tel: +44 (0)1509 882766 or 882760 Fax: +44 (0)1509 882786
Catalogue Requests	Tel: +44 (0)1509 882715 Fax: +44 (0)1509 882794

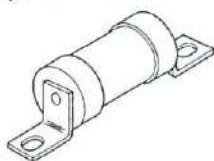
The sales desk is open from 08.00hrs until 17.30hrs GMT.



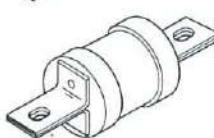
The Bussmann range of High Breaking Capacity fuse links for low voltage industrial and general applications, meet the requirements of BS88 and IEC269. Compact designs are available in current ratings up to 400 Amps, offering the end-user the advantage in space saving, whilst maintaining the thermal and electrical performance. The compact range, fully comply with the dimensional and performance requirements of the Standard. The full range of low voltage fuse links for industrial and general applications are available in ratings from 2 to 1250 Amps, in a variety of tag forms, the following illustrating some of the more popular:



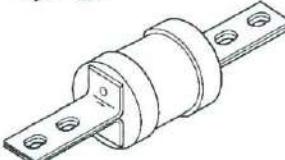
Offset Blade



Offset Bolted



Centre Bolted 2 or 4 hole fixing



Supplementary ranges cover applications up to 660 Volt ac and 500 Volt dc including those with non-standard tag fixings.

Standards

BS88: Part 1 (IEC269-1)	General requirements
BS88: Section 2.1 & 2.2 (IEC269-3)	Additional requirements for industrial fuse links (bolted type).
IEC269-3	Additional requirements for household fuse links (domestic).
BS88: Part 4 (IEC269-4)	Additional requirements for semiconductor protection fuse links.
BS88: Part 5	Additional requirements for electricity supply network (feeder pillar) fuse links.
BS88: Part 6	Additional requirements for compact fuse links (blade tag).

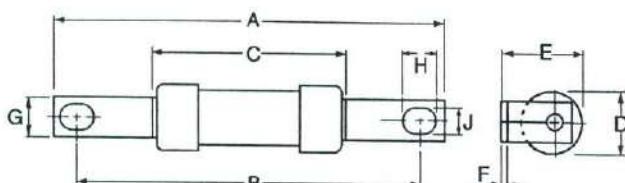
All dimensions in this catalogue are quoted in millimetres (mm)

Offset Bolted Tag

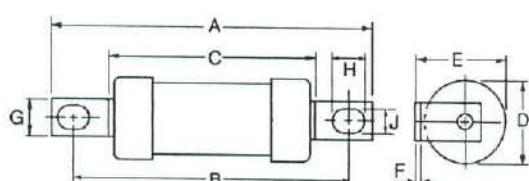
BS88: Parts 1 & 2, 1988, IEC269-1 1986

CSA C22.2 No. 106-M1985 where applicable.

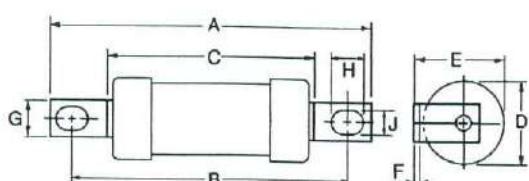
This range of Q1 fusing factor general purpose (gG) fuse links has a breaking capacity of 80kA ac and 40kA dc where applicable.



Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
AAO	85	73.5	35.5	13.7	14	1.2	8.7	8.0	5.5
AAO32M			54.5	21	22.3				



Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
BAO	87	73.5	54.5	21	22.5	1.2	12.7	8.0	5.5
BAO63M									



Catalogue Prefix	Dimensions (mm)									
	A	B	C	D	E	F	G	H	J	
CEO				21.0	24.5					
CEO100M125 & 160	110	94.0	58.5	25.8	26.8	3.2	14.3	11.0	8.7	
CEO100M200				47.0	31.0	29.5		19.0	10.0	9.0



Order Code: AAO + Rating

BS Reference: A2

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32

Motor Ratings (A): 32M40, 32M50, 32M63

Rated Voltage (V): 550 ac

Carton Quantity: 20

Fuse Holder: CAMASTER CM32F



Order Code: BAO + Rating

BS Reference: A3

Ratings (A): 40, 50, 63

Motor Ratings (A): 63M80, 63M100

Rated Voltage (V): 550 ac

Carton Quantity: 20

Fuse Holder: CAMASTER CM63F



Order Code: CEO + Rating

BS Reference: A4

Ratings (A): 32, 40, 50, 63, 80, 100

Motor Ratings (A): 100M125, 100M160, 100M200

Rated Voltage (V): 550 ac, 415 ac for Motor Fuse Links

Carton Quantity: 10

Full details of all our Fuse Holders can be found in our Circuit Components Catalogue available on request.

General Industrial Application & Motor Protection

Bussmann®



Order Code: DEO + Rating

Ratings (A): 125, 160, 200

Motor Ratings (A): 200M250, 200M315

Rated Voltage (V): 415 ac

Carton Quantity: 5



Order Code: OSD + Rating

Ratings (A): 80, 100

Motor Ratings (A): 100M125,
100M160

Rated Voltage (V): 550 ac
415 ac for Motor

Carton Quantity: 20

Fuse Holder: CAMASTER CM100F



Order Code: NITD + Rating

ES Reference: A1

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32

Motor Ratings (A): 20M25, 20M32,
32M40, 32M50,
32M63

Rated Voltage (V): 550 ac; 415 ac
for Motor Rated
32M40-63

Carton Quantity: 20

Fuse Holder: CAMASTER CM32FC



Order Code: STD + Rating

Ratings (A): 2, 4, 6, 10, 16,
20, 25, 32

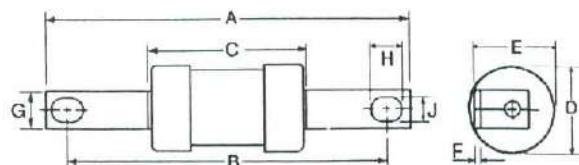
Rated Voltage (V): 240 ac

Breaking Capacity: 33kA ac

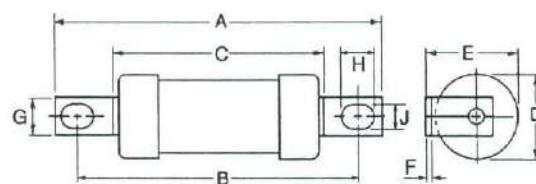
Carton Quantity: 20

Full details of all our Fuse Holders can be found in our Circuit Components Catalogue available on request.

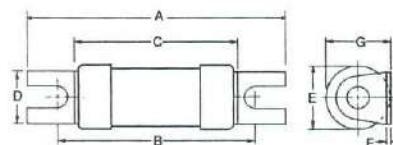
Offset Bolted Tag continued



Catalogue Prefix	Dimensions (mm)									
	A	B	C	D	E	F	G	H	I	J
DEO	110	94.0	47.0	31.0	29.5	3.2	19.0	10.0	9.0	
DEO200M										

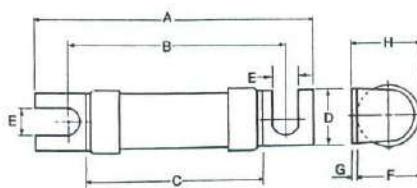


Catalogue Prefix	Dimensions (mm)									
	A	B	C	D	E	F	G	H	I	J
OSD	95.0	73.0	54.5	21.0	22.5		1.2	12.7	8.0	5.5
OSD100M				26.0	25.7					



In most motor circuit applications gG fuse links are used. Extended dual ratings of motor circuit protection with gM characteristics are available offering savings in the size and cost of Fusegear equipment.

Catalogue Prefix	Dimensions (mm)						
	A	B	C	D	E	F	G
NITD	55.0	44.5	34.6		11.2	13.8	0.8
NITD32M			35.6		17.5	1.2	18.5



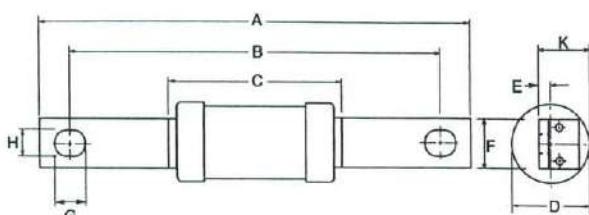
Catalogue Prefix	Dimensions (mm)							
	A	B	C	D	E	F	G	H
STD	47.0	35.0	24.0	11.0	4.7	12.0	0.8	13.0

Centre Bolted Tag

BS88: Parts 1 & 2, 1988, IEC269-1 & 2 1986

CSA C22.2 No. 106-M1985 where applicable.

This range of Q1 fusing factor general purpose (gG) fuse links has a breaking capacity of 80kA ac and 40kA dc where applicable.



Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
AC	113.5	97.5	55.5	21.0	1.6	12.7	13.5	7.0	11.2

Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
AD	128.5	111.5	55.0	21.0	1.4	14.2	11.8	8.7	11.2

Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
BC	113.5	97.5	55.5	21.0	1.6	7.0	13.5	12.7	11.2
BC63M									

Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
BD	128.5	111	55.0	21.0	1.4	14.2	11.8	8.7	11.2

Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
CD	126	111	58.5	21.0	3.2	14.3	11.1	8.7	19.5
CD100M125 & CD100M160			26.0						22.0
CD100M200	136		47.0	31.0		19.0	12.5		22.5

Order Code: AC + Rating

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32

Rated Voltage (V): 550 ac, 250 dc

Carton Quantity: 20

Order Code: AD + Rating

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32

Rated Voltage (V): 550 ac, 250 dc

Carton Quantity: 20

Order Code: BC + Rating

Ratings (A): 40, 50, 63

Motor Ratings (A): 63M80, 63M100

Rated Voltage (V): 550 ac, 250 dc;
No dc rating for
Motor Rated

Carton Quantity: 20

Order Code: BD + Rating

Ratings (A): 40, 50, 63

Rated Voltage (V): 550 ac, 250 dc

Carton Quantity: 20

Order Code: CD + Rating

BS Reference: B1

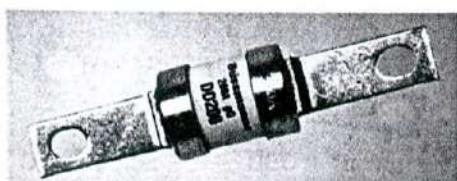
Ratings (A): 80, 100

Motor Ratings (A): 100M125,
100M160,
100M200

Rated Voltage (V): 550 ac
415 ac on Motor
Rated

Carton Quantity: 10

Centre Bolted Tag (cont.)



Order Code: DD + Rating

BS Reference: B2

Ratings (A): 125, 160, 200

Motor Ratings (A): 200M25, 200M315

Rated Voltage (V): 415 ac

Carton Quantity: 5

Order Code: ED + Rating

BS Reference: B3/B4

Ratings (A): 250, 315, 355, 400

Motor Ratings (A): 315M400,
400M500

Rated Voltage (V): 415 ac, 550 ac for
400M500

Carton Quantity: 1

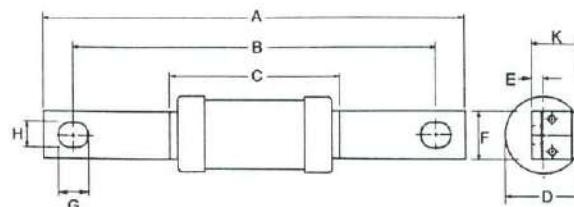
Order Code: EFS + Rating

Ratings (A): 125, 160, 200,
250, 315*

Rated Voltage (V): 415 ac

Carton Quantity: 1

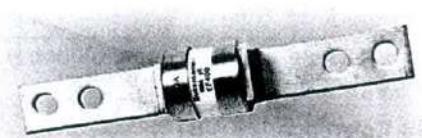
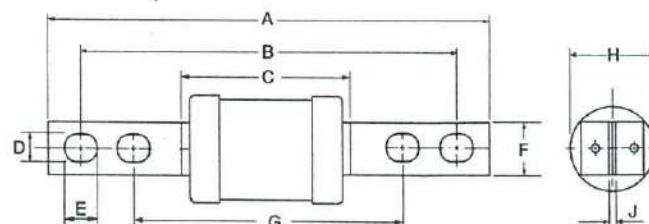
* The 315A fuse has a 4 hole fixing,
please refer to dimensional drawing
below.



Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
DD	136	110	47.0	31.0	3.2	19.0	12.5	9.0	22.5
DD200M									

Catalogue Numbers	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
ED250			47.0	31.0		19.0			22.5
ED315		111							
ED315M400	136		50.0	38.0	4.7	25.4	12.5	9.0	31.0
ED355 & 400									
ED400M500		114	75.0	59.0					

Catalogue Prefix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	K
EFS	158	133	47.0	31.0	3.2	19.0	12.5	10.5	22.5



Order Code: EF + Rating

BS Reference: C1

Ratings (A): 355, 400

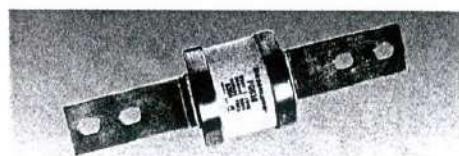
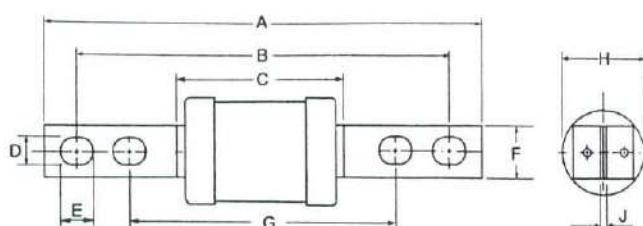
Motor Ratings (A): 400M500

Rated Voltage (V): 415 ac, 550 ac for
400M500

Carton Quantity: 1

Catalogue Numbers	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
EFS315	209	184	50.0		12.5		133	38.0	
EF355 & 400				10.5		25.4			4.7
EF400M500	210	187	75.0		15.5		136	59.0	

Centre Bolted Tag (cont.)

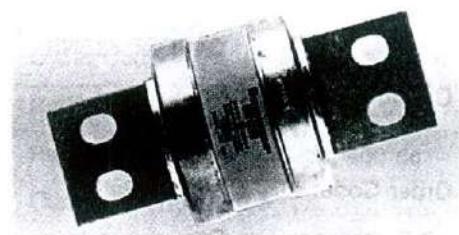
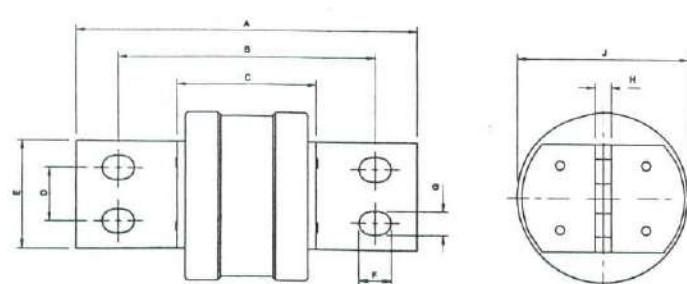


Catalogue Prefix	Dimensions (mm)									
	A	B	C	D	E	F	G	H	J	
FF	210	185	77.5	10.5	15.5	25.4	134	74.0	6.4	

Catalogue Prefix	Dimensions (mm)									
	A	B	C	D	E	F	G	H	J	
FG	262	231	77.5	10.5	15.5	38.0	167	74.0	6.4	

Catalogue Prefix	Dimensions (mm)									
	A	B	C	D	E	F	G	H	J	
GF	210	185	80.5	10.5	15.5	25.4	134.5	83.0	9.5	

Catalogue Numbers	Dimensions (mm)									
	A	B	C	D	E	F	G	H	J	
GG710 & 800	231	77.5						83.0	6.4	
GG1000 & 1250	262	228.5	84.0	10.5	15.5	38.0	165		100	12.7



Catalogue Numbers	Dimensions (mm)									
	A	B	C	D	E	F	G	H	J	
GH710 & 800	198	149	81.0	32.0	63.5	19.0	14.0	9.5	83.0	
GH1000 & 1250									100	

Order Code : GH + Rating
 BS Reference: D1
 Ratings (A): 710, 800, 1000, 1250
 Rated Voltage (V): 550 ac
 Carton Quantity: 1

Offset Blade Tag

BS88: Part 6, 1988, IEC269-1, 1986

This compact range of Q1 fusing factor general purpose (gG) fuse links have a breaking capacity of 80kA ac and 40kA dc where applicable.



Order Code: NSD + Rating

BS Reference: F1

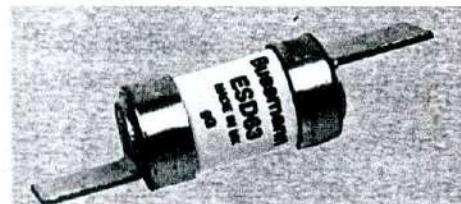
Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32

Motor Ratings (A): 20M25, 20M32, 20M36, 32M36, 32M40, 32M50, 32M63

Rated Voltage (V): 550 ac, 415 ac for Motor Rated

Fuse Holder: SAFELOC 32NNS

Carton Quantity: 20



Order Code: ESD + Rating

BS Reference: F2

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32, 40, 50, 63

Motor Ratings (A): 63M80, 63M100

Rated Voltage (V): 550 ac, 415 ac for Motor Rated

Fuse Holder: SAFELOC 63ENS

Carton Quantity: 20

Order Code: SSD + Rating

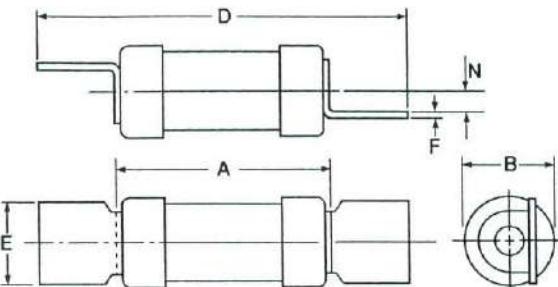
BS Reference: E1

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32

Rated Voltage (V): 240 ac

Carton Quantity: 20

Breaking Capacity: 33kA ac



Catalogue Prefix	Dimensions (mm)					
	A	B	D	E	F	N
NSD & NSD20M		13.8				
NSD20M36 & NSD32M	34.5	17.5	58.5	12.7	0.8	3.5

Catalogue Prefix	Dimensions (mm)					
	A	B	D	E	F	N
ESD2 - 32A		13.8				
ESD40 - 63A	35.5	17.5	68.0	15.0	1.2	3.5
ESD63M		21.0				

Catalogue Prefix	Dimensions (mm)					
	A	B	D	E	F	N
SSD	23.0	12.0	47.0	13.0	0.8	3.2

Full details of all our Fuse Holders can be found in our Circuit Components catalogue, available on request.

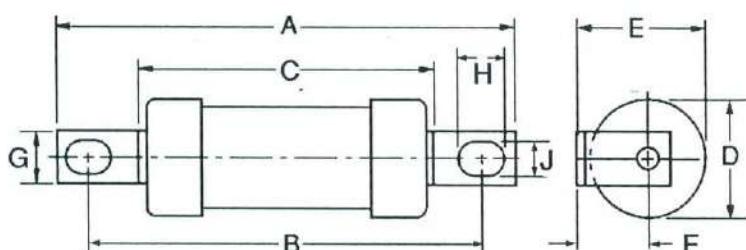
Offset Bolted Tags

BS88: Parts 1 & 2, IEC269, Parts 1 & 2

The use of 660V ac systems for large industrial plants has not evolved to any significant extent the majority of applications remaining at 415V. However, for applications above 415 and 550V ac Bussmann offer the 660V range of fuse links which meet the dimensional and performance requirements of BS88 and IEC269 Parts 1 and 2. The fuse links are available with offset and centre bolted tags.



Order Code: Rating + H07-660
 BS Reference: A2
 Ratings (A): 2, 4, 6, 10, 16, 20,
 25, 32
 Rated Voltage (V): 660 ac, 250 dc
 Carton Quantity: 20
 Fuse Holder: CAMASTER CM32F



Order Code: Rating + K07-660
 BS Reference: A3
 Ratings (A): 40, 50, 63
 Rated Voltage (V): 660 ac, 250 dc
 Carton Quantity: 20
 Fuse Holder: CAMASTER CM63F
 and CM100F

Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
H07-660	82.3	71.5	52.0	22.0	22.4	11.5	8.7	7.7	5.4
K07-660	86.0	71.5	54.2	25.8	26.9	14.0	12.7	10.5	5.5
L14-660	111.0	94.5	67.0	35.5	37.0	19.2	19.0	10.3	8.7
M14-660	112.0	94.0	66.0	38.0	38.0	19.0	19.0	10.0	8.5

Order Code: Rating + L14-660
 BS Reference: A4
 Ratings (A): 80, 100
 Rated Voltage (V): 660 ac, 400 dc
 Carton Quantity: 10

Order Code: Rating + M14-660
 Ratings (A): 125, 160, 200
 Rated Voltage (V): 660 ac, 400 dc
 Carton Quantity: 5

Full details of all our Fuse Holders can be found in our Circuit Components catalogue, available on request.

Centre Bolted Tags



Order Code: Rating + K08-660

Ratings (A): 2, 4, 6, 10, 16, 20,
32, 40, 50, 63

Rated Voltage (V): 660 ac, 250 dc

Carton Quantity: 20

Order Code: Rating + K09-660

Ratings (A): 2, 4, 6, 10, 16, 20,
32, 40, 50, 63

Rated Voltage (V): 660 ac, 250 dc

Carton Quantity: 20

Order Code: Rating + L09-660

BS Reference: B1

Ratings (A): 80, 100

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 10

Order Code: Rating + M09-660

BS Reference: B2

Ratings (A): 125, 160, 200

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 5

Order Code: Rating + N09-660

BS Reference: B3

Ratings (A): 250, 315

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

Order Code: Rating + P09-660

BS Reference: B4

Ratings (A): 355, 400

Rated Voltage (V): 660 ac, 400 dc

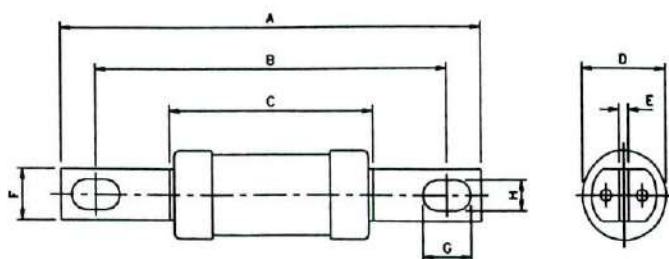
Carton Quantity: 1

Order Code: Rating + N11-660

Ratings (A): 125, 160, 200,
250, 315

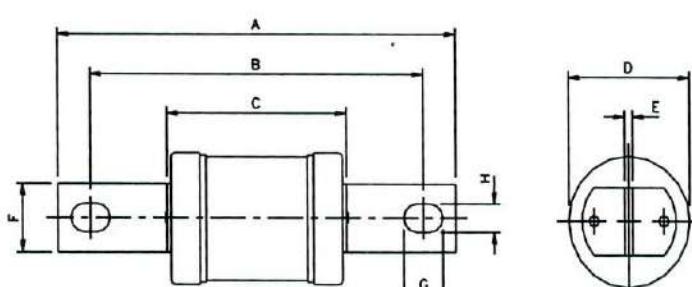
Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1



Catalogue Number	Dimensions (mm)							
	A	B	C	D	E	F	G	H
2-32A K08-660	111.0	92.5	53.7	22.0		2.4	12.7	13.0
40-63A K08-660	111.5	93.0	54.2	25.0				7.5

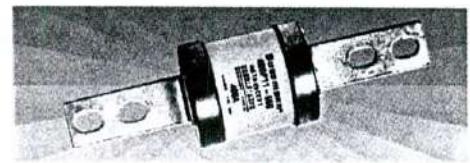
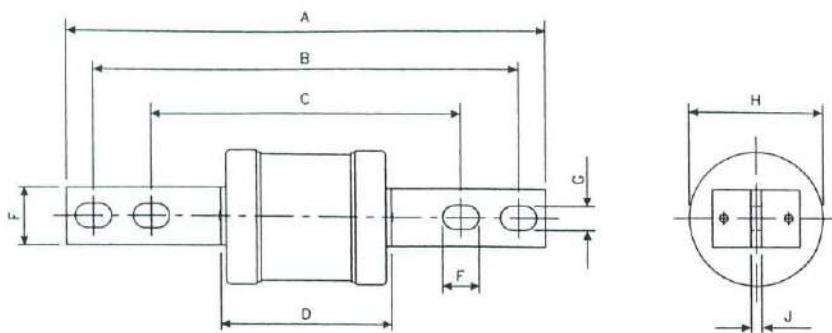
Catalogue Number	Dimensions (mm)							
	A	B	C	D	E	F	G	H
2-32A K09-660	127.0	106	53.7	22.0		2.4	14.0	15.2
40-63A K09-660	128.0	106.5	54.2	25.0				8.7



Catalogue Suffix	Dimensions (mm)							
	A	B	C	D	E	F	G	H
L09-660	136.0	110.5	65.5	35.5	3.2	19.0	15.1	8.7
M09-660	135.0	110.0	65.0	37.0	3.2	19.0	15.0	8.7
N09-660	135.0	113.0	73.0	49.0	3.2	25.4	12.7	9.5
N11-660	162.0	135.0	73.0	49.0	3.2	25.4	15.8	10.5
P09-660	135.5	113.5	75.0	58.5	4.7	25.4	12.7	9.5

General Information & Dimensions - Centre Bolted Tags

Centre Bolted Tags - 4 holes



Order Code: Rating + P11-660
BS Reference: C1
Ratings (A): 355, 400
Rated Voltage (V): 660 ac, 400 dc
Carton Quantity: 1

Order Code: Rating + P12-660
Ratings (A): 355, 400
Rated Voltage (V): 660 ac, 400 dc
Carton Quantity: 1

Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
P11-660	212.0	187.0	136.0	75.0	25.4	16.0	10.0	59.0	5.0
P12-660	262.0	231.0	167.0						

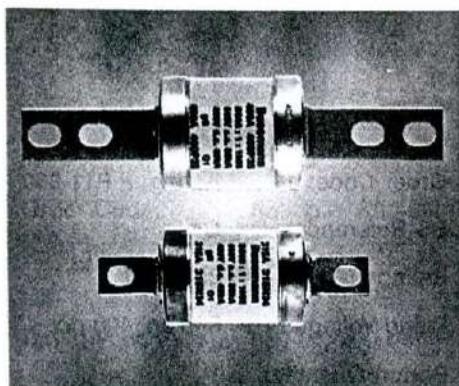
Order Code: Rating + R11-660
BS Reference: C2
Ratings (A): 450, 500, 560, 630
Rated Voltage (V): 660 ac, 400 dc
Carton Quantity: 1

Order Code: Rating + R12-660
Ratings (A): 450, 500, 560, 630
Rated Voltage (V): 660 ac, 400 dc
Carton Quantity: 1

Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
R11-660	210.0	186.0	135.0	76.0	26.0	16.0	10.0	74.0	6.5
R12-660	262.0	231.0	167.0						

Offset Bolted Tag

BS88 do not allocate a reference number to these fuse links.
Rated breaking capacity 80kA ac 40kA dc



Order Code: Rating + M13

Ratings (A): 125, 160, 200

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 5

Order Code: Rating + M23

Ratings (A): 125, 160, 200

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

Order Code: Rating + N15

Ratings (A): 250, 315

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

Order Code: Rating + N34

Ratings (A): 250, 315

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

Order Code: Rating + P35

Ratings (A): 355, 400

Rated Voltage (V): 660 ac, 400 dc

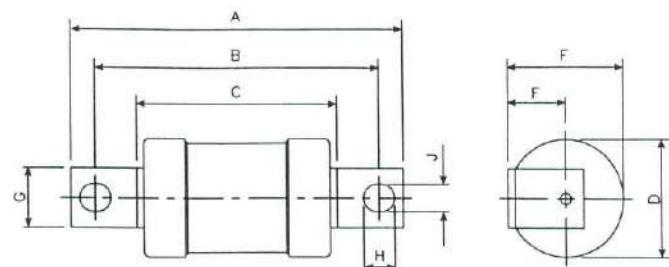
Carton Quantity: 1

Order Code: Rating + R40

Ratings (A): 450, 500

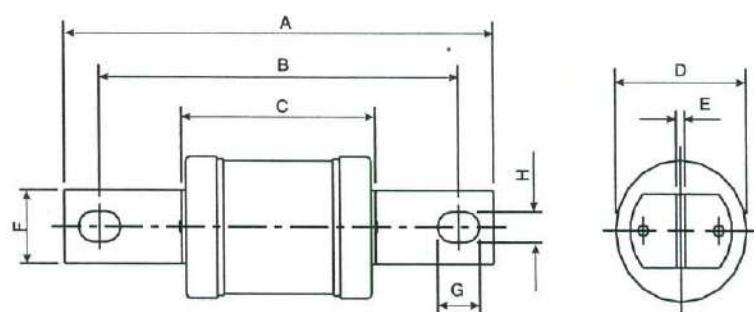
Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

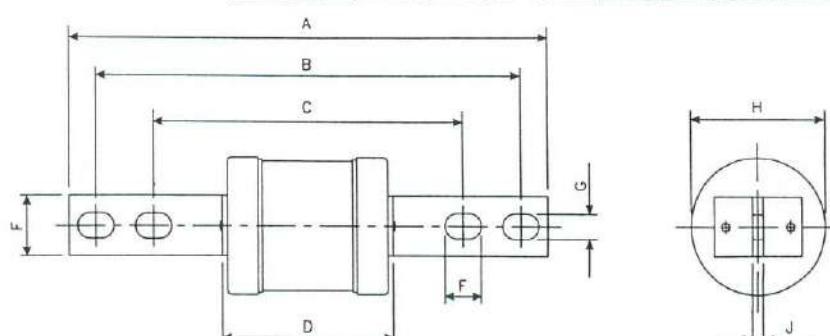


Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
M13	120.0	99.0	70.0	38.0	27.0	8.0	12.0	8.7	
M23	262.0	231.0	167.0		38.5	19.0			26.0
N15	120.0	100.0	79.0	49.0	41.0	16.5		15.0	9.8

Centre Bolted Tag

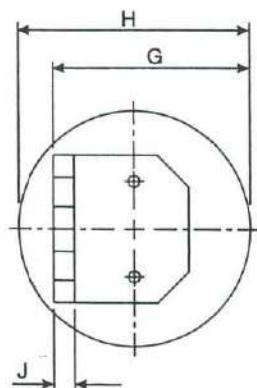
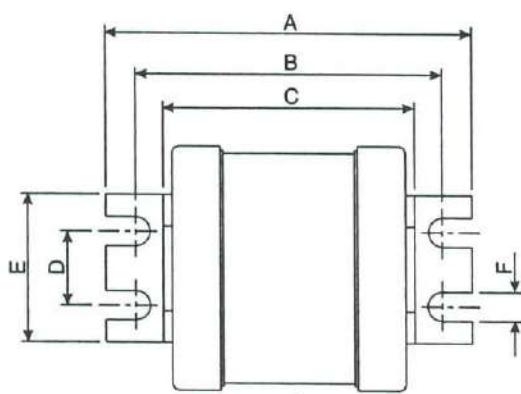


Catalogue Suffix	Dimensions (mm)							
	A	B	C	D	E	F	G	H
N34	135.0	113.0	74.5	66.5	5.0	25.4	12.5	9.5



Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
P35	210.0	187.0	136.0	75.0	19.0	16.0	10.0	59.0	5.0
R40		185.0	135.0	81.0				74.0	9.5

Special Offset Tag



Order Code: Rating + N20

Ratings (A): 125, 160, 200,
250, 315

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

Order Code: Rating + P20

Ratings (A): 355, 400

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

Order Code: Rating + R20

Ratings (A): 450, 500, 560, 630

Rated Voltage (V): 660 ac, 400 dc

Carton Quantity: 1

Order Code: Rating + S20

Ratings (A): 710, 800

Rated Voltage (V): 550 ac

Carton Quantity: 1

Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
N20	110.0	92.5	75.0	22.0	44.5	8.8	49.0	49.0	6.4
P20	111.0		76.0				47.0	59.0	
R20	112.0	94.0	77.0	77.0			62.0	74.0	6.4
S20	112.0		77.0				66.0	83.0	

Offset Bolted Tags



Order Code: Rating + HS07

Ratings (A): 10, 16, 20, 25, 32

Rated Voltage (V): 500 dc

Carton Quantity: 20

Order Code: Rating + KS07

Ratings (A): 40, 50, 63

Rated Voltage (V): 500 dc

Carton Quantity: 20



Order Code: Rating + KS08

Ratings (A): 40, 50, 63

Rated Voltage (V): 500 dc

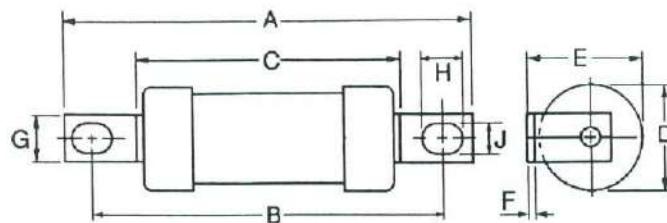
Carton Quantity: 20

Order Code: Rating + KS09

Ratings (A): 10, 16, 20, 25, 32,
40, 50, 63

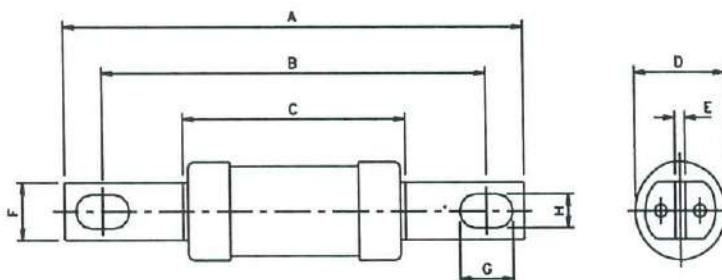
Rated Voltage (V): 500 dc

Carton Quantity: 20



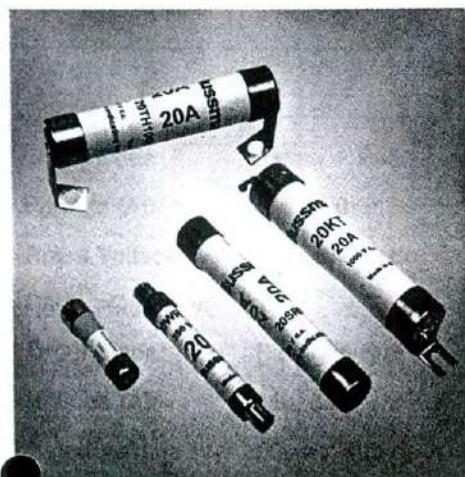
Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	J
HS07	86.0	73.0	54.0	22.0	-	0.8	9.2	8.0	5.0
KS07	91.0			27.0		1.2	13.0	10.5	

Centre Bolted Tag



Catalogue Suffix	Dimensions (mm)								
	A	B	C	D	E	F	G	H	
KS08	113.0	98.0		56.0	27.0	2.5	13.0	13.0	5.0
KS09	138.0	111.0					14.5	15.0	8.0

DC Traction Fuse Links



Bussmann manufactures fuse links for dc circuits. Fuse links are also available in a variety of railway industry standard sizes, together with custom designed products for traction applications. Please call our Application Engineers for further information. (See useful phone numbers on page 1).

The Bussmann Standard range of high breaking capacity fuse links for low voltage industrial and general purpose applications, meet the requirements of BS88 and IEC269. By using advanced fuse technology, the current ratings, up to 400A, have compact dimensions but still within the standardised dimensional and performance requirements. These designs have been epitomised for 315/240V systems. The standard range of fuse links are available from 2-1250A in the following tag forms: Offset Blade - Offset Bolted - Centre Bolted.

Supplementary ranges cover applications up to 660V ac and 500V dc including those with nonstandard tag fixings.

Bussmann fuse links are manufactured under Quality Systems independently assessed to BS5750 (ISO9002) and appropriate ratings carry the ASTA20 endorsement.

Application Data

One of the long standing advantages of fuse protection is that fuse selection is relatively simple and effective.

The following notes should cover the majority of applications. For further information contact our Application Engineers on 01509 882766 and 882760.

Reference should also be made to the appropriate Wiring Installation rules, in the UK the 16th edition of the IEE Wiring Regulations for Electrical Installation (BS7671) which aligns with IEC364.

Circuit Loading

The current rating of the fuse link should not be less than the full load current of the circuit. The circuit should be so designed that small overloads of long duration will not be of frequent occurrence.

Cable Ratings

There is an increasing move away from 70 degrees C PVC insulation to materials which are more environmentally friendly, for example 90 degrees C XLPE. The ratings of fusegear, switches, accessories etc. are generally based upon the equipment being connected to conductors intended to be operated at a temperature not exceeding 70 degrees C in normal service.

In view of the above it is recommended that the practice of designs based upon conductor temperatures of 70 degrees C be regarded as the norm. In accordance with clause 512-02-01 of the Wiring Regulations, the equipment manufacturer should be consulted to ascertain the reduction of nominal current rating of the equipment if conductor temperatures exceeding 70 degrees C are used. In addition, an overriding factor is often voltage drop.

Cable Protection

Bussmann fuse links with gG characteristics protect associated cables against both overload and short circuit current, provided that the current rating of the fuse link I_{n} is equal or less than the current carrying capacity of the cable I_{z} .

In motor circuits, the motor starter will provide the overload protection and the fuse links will provide the short circuit protection. The maximum size of fuse link that can be used depends upon the type of cable used and is determined in accordance with the Wiring Regulations using the appropriate K factor. The following table gives the maximum sizes of fuse links that are recommended for two popular cables with copper conductors, 70 degrees C PVC ($K = 115$) and 90 degrees C thermosetting ($K = 143$).

Cable Size mm ²	Max. Fuse Rating	
	K = 115 A	K = 143 A
1	16	16
1.5	20	25*
2.5	32*	32*
4	50*	50*
6	63*	63*
10	100*	125*
16	125*	160*
25	200*	250*
35	315*	355*
50	400*	500
70	560	630
95	710	800
120	800	1000

Protection Against Electrical Shock

The rules for protection against indirect contact are given in Chapter 413 of the wiring regulations.

For a TN System a disconnecting time not exceeding 5s is permitted for a distribution circuit. The maximum values of earth fault loop impedance (Z_s) of 240V for Bussmann gG fuse links to BS88: Parts 2 and 6 are:

Rating (A)	Z _s Ohms	Rating (A)	Z _s Ohms
6	14	100	0.44
10	7.7	125	0.35
16	4.3	160	0.27
20	3.0	200	0.20
25	2.4	250	0.16
32	1.9	315	0.13
40	1.4	400	0.096
50	1.1	500	0.073
63	0.86	630	0.054
80	0.60	800	0.044

Ambient Temperature

The de-rating in terms of current of 0.5% per degree centigrade above an ambient of 35 degrees C is recommended.

Breaking Capacity

The standardised values of Breaking Capacity are 80kA for voltages of 415V ac and above, and 40kA for dc applications. The 240V ac designs have a breaking capacity of 50kA.

Discrimination

All fuse links to BS88 Parts 2 and 6 will give a discrimination ratio of 2:1 and for most practical situations a ratio of 1.6:1 (two steps in the R10 series). Example: an upstream fuse rated at 160A will discriminate with a downstream fuse rated at 100A.

Current and Energy Limitation

The Bussmann range of fuse links have pre-arcing I_t values towards the bottom limits of BS88 Parts 2 and 6. This ensures excellent current and energy limitation, they also have lower power losses at rated current. This assists in the appropriate interchangeability with other makes of fuse links.

Transformers

When fuse links are used on the primary side of transformers the normal current rating of the fuse link should be at least twice the nominal transformer primary current.

Fluorescent Lighting

The normal current rating of the fuse link should be at least twice the normal full load current of the maximum number of lights to be switched simultaneously.

Capacitor Circuits

In capacitor circuits, for example, power factor correction, the fuse link should be chosen with a current rating greater than 1.5 times the rated capacitor current. This takes account of the high transient inrush current, circuit harmonics and capacitor tolerances.

Motor Circuits

In Motor Circuits the fuse link has to withstand the starting current of the motor and often requires a higher rating than the full load current of the motor.

Co-ordination recommendations are made by the manufacturers of motor starters in accordance with IEC947-4-1, to give the desirable type 2 co-ordination with fuse links, tests are performed with the latest gG or gM fuse links to BS88 or IEC269 which have pre-arcng I_t values towards the bottom of specified limits. This means that Bussmann fuse links are suitable to provide type 2 co-ordination.

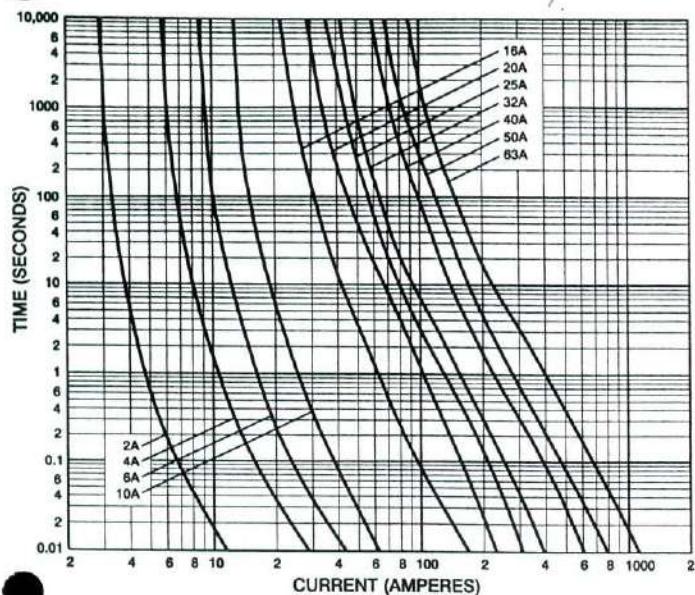
Extended dual ratings of motor circuit protection fuse links with gM characteristics are available in most popular sizes of fuse links to extend the use of associated equipment with appropriate economies. In the majority of applications, gG fuse links are used. It is not essential for gM fuse links to be used for motor circuit protection, they simply extend the utilisation of standard equipment.

The table below shows the recommended fuse links at 415V. In most applications the run-up time is less than 5 seconds and duty is infrequent - no more than twice per hour. The next larger rating should be used for more arduous conditions.

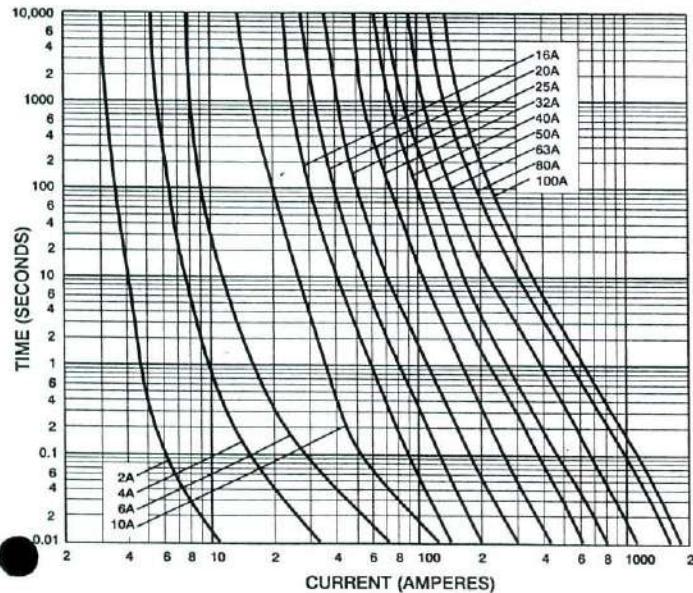
Motor Rating kW	A	Direct On-line		Asst. Start Standard (gG)
		Standard (gG)	Motor Circuit (gM)	
0.25	0.8	4	-	2
0.37	1.1	4	-	2
0.55	1.5	6	-	4
0.75	2.0	6	-	4
1.1	3.0	10	-	6
1.5	3.6	16	-	10
2.2	5.0	16	-	10
3.0	6.5	20	-	16
4.0	8.4	20	-	16
5.5	11.0	25	20M25	20
7.5	15.0	40	32M40	25
11.0	20.0	50	32M50	32
15.0	27.0	63	32M63	40
18.5	33.0	80	63M80	50
22.0	38.0	80	63M80	50
30.0	54.0	100	63M100	80
37.0	66.0	125	100M125	80
45.0	79.0	160	100M160	100
55.0	98.0	160	100M160	100
75.0	135.0	250	200M250	160
90.0	155.0	250	200M250	160
110.0	185.0	315	200M315	200
132.0	220.0	355	315M400	250
150.0	250.0	355	315M400	315
185.0	310.0	450	400M500	355
200.0	335.0	500	400M500	400
225.0	375.0	560	-	400
250.0	415.0	560	-	450
280.0	460.0	630	-	500
335.0	562.0	710	-	630
355.0	596.0	800	-	710

* Extended Motor Circuit dual ratings can be used

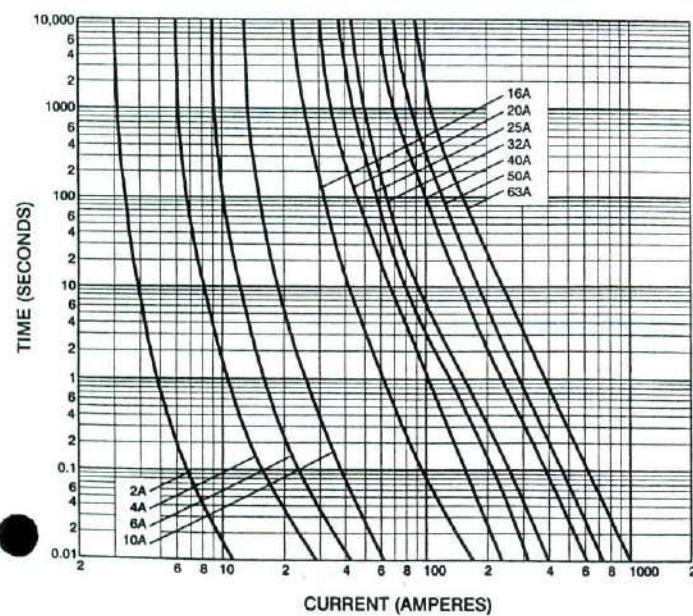
Time Current Curve for AAO, BAO BC and BD Fuse Links



Time Current Curve for AC, AD, CD, CEO, and OSD Fuse Links



Time Current Curve for NSD, NITD and ESD Fuse Links



Catalogue Prefix	$\int I^2 dt$ (Amps ² Seconds)			Nom. Watts Loss		
	Amp Ratings	Pre-Arcing	Total at 415V			
AAO	2	1.4	4.7	0.9		
	4	7.8	26	1.4		
	6	28	100	1.8		
	10	125	400	2.1		
	16	120	470	1.8		
	20	260	1000	1.8		
	25	570	2300	2.0		
	32	710	3000	2.9		
BAO	BC	BD	40	1400	3600	4.7
BAO	BC	BD	50	3000	8000	4.9
BAO	BC	BD	63	6700	18800	5.6

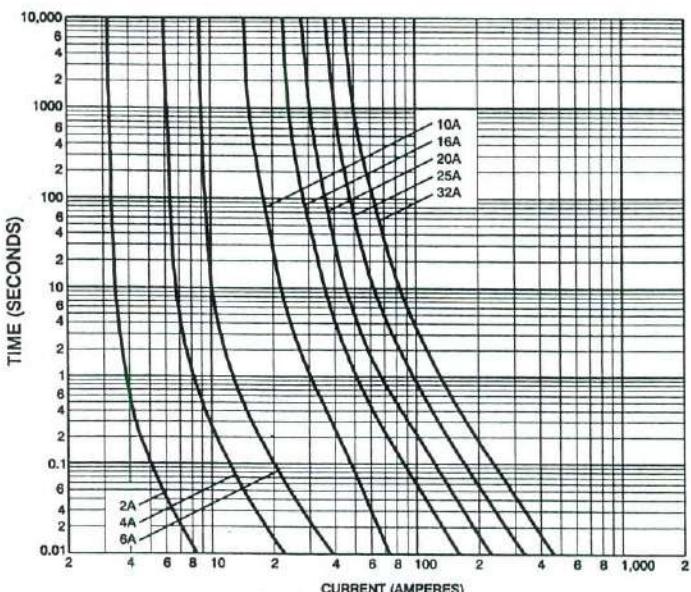
Catalogue Prefix	$\int I^2 dt$ (Amps ² Seconds)			Nom. Watts Loss		
	Amp Ratings	Pre-Arcing	Total at 415V			
AC	AC	AD	2	1.2	3.1	1.2
	AC	AD	4	11	31	1.4
	AC	AD	6	32	90	1.8
	AC	AD	10	20	60	2.4
	AC	AD	16	85	240	2.9
	AC	AD	20	220	580	3.1
	AC	AD	25	500	1400	3.2
	CEO	AC	32	1000	2760	3.5
CEO			40	1400	3750	4.7
			50	3000	8350	4.9
			63	7000	18800	5.6
	CEO	CD	80	13000	35200	7.2
CEO	CD	OSD	100	25000	76500	8.5

Catalogue Prefix	$\int I^2 dt$ (Amps ² Seconds)			Nom. Watts Loss		
	Amp Ratings	Pre-Arcing	Total at 415V			
NSD	NITD	ESD	2	1.3	4.6	0.9
NSD	NITD	ESD	4	8	27	1.4
NSD	NITD	ESD	6	29	100	1.8
NSD	NITD	ESD	10	120	400	2.1
NSD	NITD	ESD	16	120	470	1.8
NSD	NITD	ESD	20	260	1070	1.8
NSD	NITD	ESD	25	560	2300	2.0
NSD	NITD	ESD	32	710	3000	2.9
ESD			40	1500	6000	3.2
			50	2700	8700	3.9
			63	5000	13300	4.6

Electrical Protection

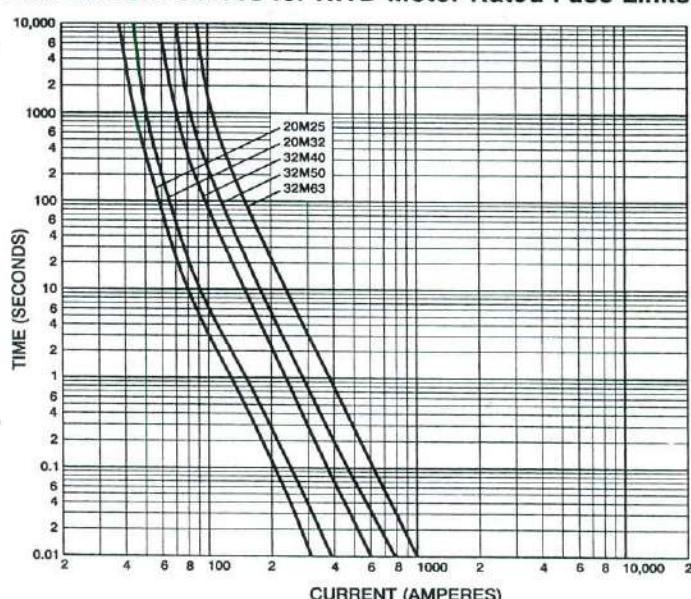
Time Current Curves for SSD and STD Fuse Links

Catalogue Prefix		I ^t (Amps ² Seconds)			Nom. Watts Loss
		Amp Ratings	Pre-Arcing	Total at 415V	
SSD	STD	2	0.8	1	0.5
SSD	STD	4	5.5	8	1.0
SSD	STD	6	15	22	1.6
SSD	STD	10	28	42	1.2
SSD	STD	16	160	250	1.5
SSD	STD	20	290	450	1.7
SSD	STD	25	800	1300	1.8
SSD	STD	32	1600	2500	2.4



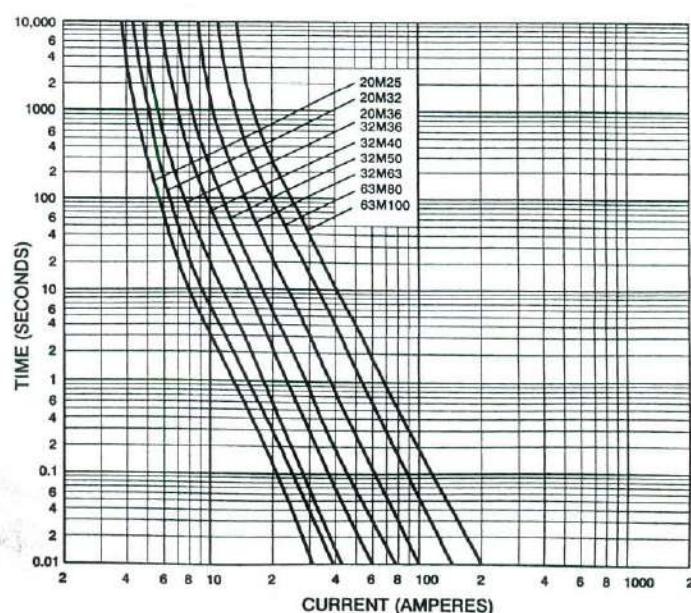
Time Current Curves for NITD Motor Rated Fuse Links

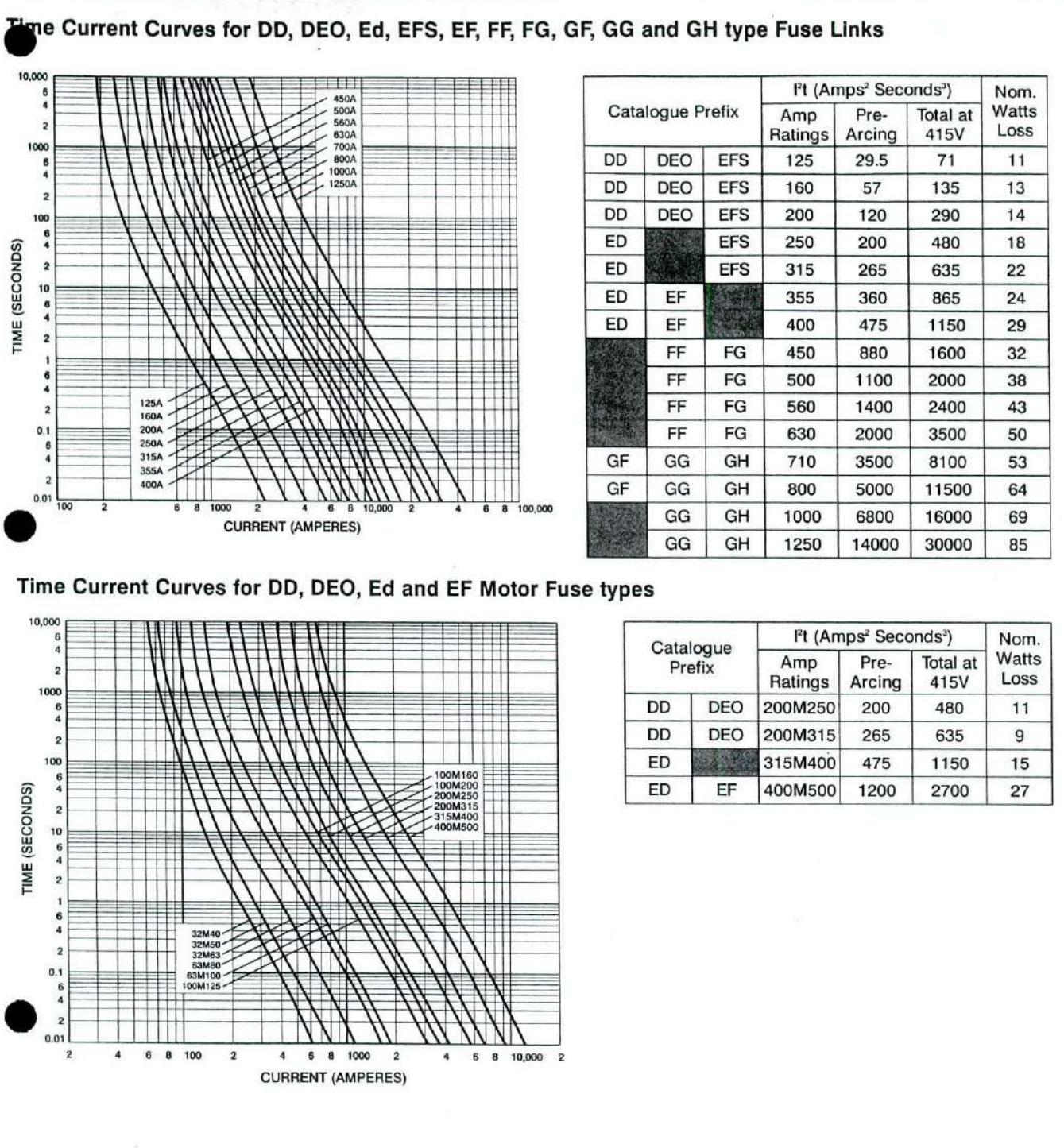
Catalogue Prefix		I ^t (Amps ² Seconds)			Nom. Watts Loss
		Amp Ratings	Pre-Arcing	Total at 415V	
NITD	20M25	575	2300	1.6	
NITD	20M32	720	3000	1.1	
NITD	32M40	1500	6000	1.9	
NITD	32M50	2700	8600	1.4	
NITD	32M63	5000	13400	1.0	



Time Current Curves for NSD, AAO and BAO Motor Fuse Links

Catalogue Prefix		I ^t (Amps ² Seconds)			Nom. Watts Loss
		Amp Ratings	Pre-Arcing	Total at 415V	
NSD	20M25	570	2350	1.2	
NSD	20M32	770	3000	0.95	
NSD	20M36	1150	5000	0.88	
NSD	32M36	1150	5000	2.4	
NSD	32M40	1500	6000	1.9	
NSD	32M50	2700	8700	1.4	
NSD	32M63	5000	13550	1.0	
AAO	32M40	1400	3800	3.0	
AAO	32M50	3000	8500	2.0	
AAO	32M63	7000	18000	1.4	
BAO	63M80	12600	12600	4.4	
BAO	63M100	24000	24000	3.4	





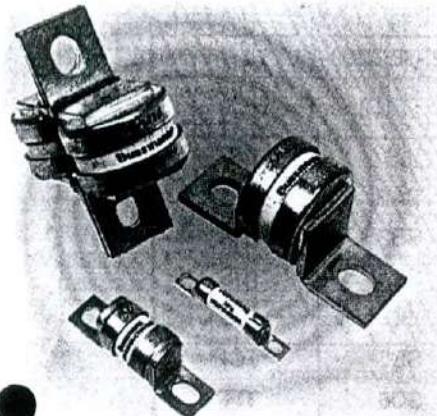
Bussmann do not guarantee identical performance for the comparative types shown. The list is intended for guidance only, but under normal circumstances satisfactory interchangeability should be achieved.

Offset Bolted Tag Fuse Links to BS88 Parts 1 & 2 - IEC269-1					
Ratings (A)	Voltage (V)	Fixing Centres	Bussmann Prefix	Other Prefix	
2-32	240	37.5	STD	LS	LST
2-32	550	44.5	NITD	SA2	NIT
2-32	550	73	AAO	SB3	TIA
40-63	550	73	BAO	SB4	TIS
80-100	550	73	OSD	SO	OS
32-100	550	94	CEO	SD5	TCP
125-200	415	94	DEO	SD6	TFP
Centre bolted Tag Fuse Links to BS88 Parts 1 & 2 - IEC269-1 & 2					
2-32	550	97	AC	SE3	TB
2-32	550	111	AD	SF3	TBC
40-63	550	97	BC	SE4	TB
40-63	550	111	BD	SF4	TBC
80-100	550	111	CD	SF5	TC
125-200	415	111	DD	SF6	TF
250-400	415	111	ED	SF7	TKF
125-250	415	133	EFS	SG7	TKM
315			EFS	SG7	TKM
355	415	133/184	EF	SH8	TM
400			EF	SH8	TM
450-630	550	133/184	FF	SH9	TTM
450-630	550	165/228	FG	SY9	TT
710-800	550	133/184	GF	SH10	TLM
710-1250	550	165/228	GG	SY10	TLT
710				-	TLU
800				-	
1000	550	149	GH	SJ11	TXU
1250				SJ11	
Offset Blade Fuse Links to BS88 Part 6 - IEC269-1					
Rating (A)	Voltage (V)	Overall Length	Bussmann Prefix	Other Prefix	
2-32	240	48	SSD	SS	SS
2-32	550	58.7	NSD	SN2	NS
2-63	550	67.3	ESD	SP	ES

Bussmann offers a comprehensive range of High Speed Fuse Links for Semiconductor device protection. For more comprehensive information on our Semiconductor range of fuse links, please ask for our catalogue on semiconductor protection titled 'High Speed Fuses'.

240 Volt ac, 150 Volt dc - 6 to 900 Amps; 660 Volt ac, 450 Volt dc - 6 to 700 Amps

UL recognised, BS88: Part 4, IEC269: Part 4



Order Code: Rating + LCT

Ratings (A): 6, 10, 12, 16, 20

Rated Voltage (V): 240 ac, 150 dc

Carton Quantity: 20

Order Code: Rating + LET

Ratings (A): *7, *10, *12, *16,
25, 32, 35, 50, 63,
80, 100, 125, 160,
180

Rated Voltage (V): 240 ac, 150 dc

Carton Quantity: 10

Order Code: Rating + LMT

Ratings (A): 160, 200, 250, 315,
355, 400, 450

Rated Voltage (V): 240 ac, 150 dc

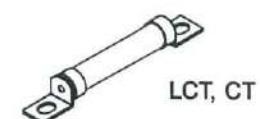
Carton Quantity: 1

Order Code: Rating + LMMT

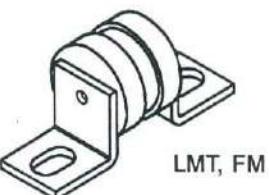
Ratings (A): 400, 500, 630,
710, 800, 900

Rated Voltage (V): 240 ac, 150 dc

Carton Quantity: 1



LCT, CT



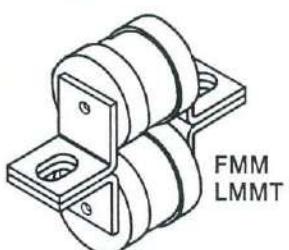
LMT, FM



LET, ET
FE



FEE, EET



FMM
LMMT

Order Code: Rating + CT

Ratings (A): 6, 10, 12, 16, 20

Rated Voltage (V): 660 ac

Carton Quantity: 20

Order Code: Rating + ET

Ratings (A): *8, *12, *15, *20,
25, 32, 35, 40, 45,
56, 63, 80

Rated Voltage (V): 660 ac

Carton Quantity: 10

Order Code: Rating + FE

Ratings (A): 35, 40, 45, 50, 63,
71, 80, 90, 100

Rated Voltage (V): 660 ac

Carton Quantity: 10

Order Code: Rating + EET

Ratings (A): 65, 75, 90, 110,
140, 160

Rated Voltage (V): 660 ac

Carton Quantity: 5

Order Code: Rating + FEE

Ratings (A): 100, 120, 140,
160, 180, 200

Rated Voltage (V): 660 ac

Carton Quantity: 5

Order Code: Rating + FM

Ratings (A): 180, 200, 225, 250,
280, 315, 350

Rated Voltage (V): 660 ac

Carton Quantity: 1

Order Code: Rating + FMM

Ratings (A): 400, 450, 500,
550, 630, 700

Rated Voltage (V): 660 ac

Carton Quantity: 1

Order Code: Rating + MT

Ratings (A): *160, *180, *200,
*250, *280, *315,
*355

Rated Voltage (V): 660 ac

Carton Quantity: 1

Indicator Ordering Information

Fuse Type	Order Reference
ET	EC-600
EET	EC-600
FE	EC-600
FEE	EC-600
LET	EC-250
MT	MC-700
FM	MC-600
FMM	MC-600
LMT	MC-250
LMMT	MC-250

* Not UL recognised.

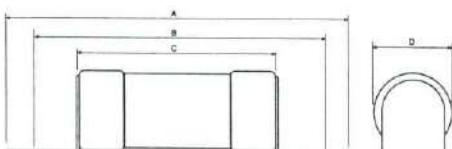
Trip-indicator fuse links are available for use in parallel with the main fuse link. The trip-indicators can be mounted onto the associated fuse link (see table right) or, mounted separately in panel mounted fuse clips - Ref. CLI. A push-on adaptor and microswitch attachment is available to use with the trip-indicator to facilitate remote indication - Ref. MAI.

Originally developed for the Admiralty, Joint Service fuse links are now used in a wide variety of applications wherever space is at a premium, e.g. in the electronic, aeronautical and allied industries.

Defence Standard 59-96 (superceding DEF63) Tested to BS88 at 440 Volts 33kA.



Cylindrical (Cyl)



Offset Bolted Tag (O.B.T)

Catalogue Number	Rating	Body Size	Tag Type	A	B	C	D	E
059-0107	0.25							
059-0108	0.5							
059-0109	1							
059-0110	2							
059-0111	3	0	Cyl.	32.05	-	-	6.37	5.55
059-0112	5							
059-0113	7							
011-9925	10							
011-9926	15							
059-0140	0.5							
059-0141	1							
059-0142	2							
059-0143	3							
059-0144	5	1	Cyl.	33.6	-	-	11.86	7.14
059-0145	7							
059-0146	10							
059-0147	15							
011-9483	20							
059-0114	0.5							
059-0115	1							
059-0116	2							
059-0117	3							
059-0118	5	1	O.B.T.	56.03	44.65	33.9	11.96	-
059-0119	7							
059-0120	10							
059-0121	15							
011-9679	20							
012-0140	30							
059-0148	10							
059-0149	15	2	Cyl.	37.6	-	-	16.7	8.71
059-0150	20							
059-0151	30							
059-0122	10							
059-0123	15							
059-0124	20							
059-0125	30	2	O.B.T.	70.7	55.84	37.4	16.7	-
012-0067	40							
011-9127	50							
012-0141	60							
059-0152	40							
059-0153	60	3	Cyl.	47.9	-	-	33.3	11.9
059-0154	80							
059-0155	100							
059-0126	40							
059-0127	60							
059-0128	80							
059-0129	100	3	O.B.T.	88.6	69.77	47.4	33.3	-
011-9128	125							
011-9129	150							

All dimensions in mm



Body Size: 0
End Cap: Cylindrical
Ratings (A): 0.25, 0.5, 1, 2, 3, 5, 7, 10,
15

Rated Voltage (V): 440 ac

Carton Quantity: 100

Data sheet number: 4188

— 1 —

Body Size: 1
End Cap: Cylindrical and Offset Bolted Tag
Ratings (A): 0.5, 1, 2, 3, 5, 7, 10, 15,
20 + 30 in O.B.T. only
Rated Voltage (V): 440 ac
Carton Quantity: 25
Data sheet number: 4189

Body Size:	2
End Cap:	Cylindrical
Ratings (A):	10, 15, 20, 30,
End Cap:	Offset Bolted Tag
Ratings (A):	10, 15, 20, 30, 40, 50, 60
Rated Voltage (V):	440 ac
Carton Quantity:	25
Data sheet number:	4190.

Body Size:	3
End Cap:	Cylindrical
Ratings (A):	40, 60, 80, 100
End Cap:	Offset Bolted Tag
Ratings (A):	40, 60, 80, 100, 125, 150
Rated Voltage (V):	440 ac
Carton Quantity:	25
Data sheet number:	4191

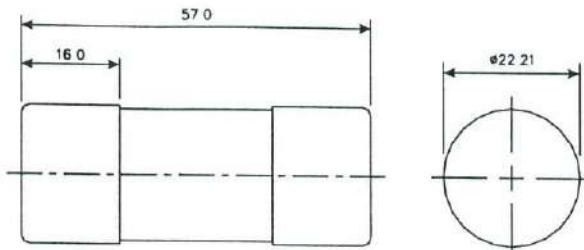


House Service Cut-out Fuse Links

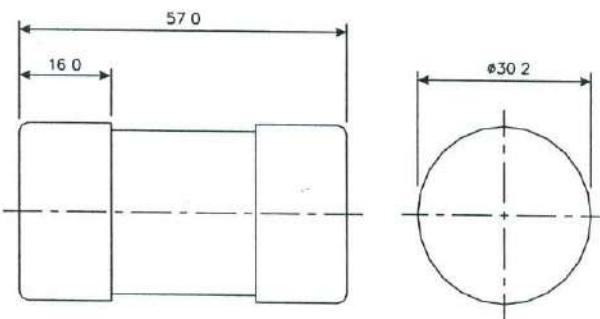
Designed for use in conventional house service cut-outs, ASTA certified and tested in accordance with BS1361.

Cylindrical Types

Dimensions in mm



Dimensions for KR85



Dimensions for LR85

Order Code: Rating + KR85

Ratings (A): 5, 10, 15, 20, 25,
30, 40, 45, 50, 60,
70, 80, 90, 100

Rated Voltage (V): 415 ac

Carton Quantity: 20

Data sheet number: 4185

Order Code: Rating + LR85

Ratings (A): 30, 40, 50, 60, 80,
100

Rated Voltage (V): 415 ac

Carton Quantity: 20

Data sheet number: 4186

Type 'J' Cylindrical Fuse Links

Bussmann type 'J' Low Voltage HRC Fuse Links are designed for use with wedge type fuse carriers. These fuse links are primarily for use by Electricity Supply Authorities in distribution pillars, open type substation boards, heavy duty service cutouts and underground connecting boxes. Type 'J' are available with either slotted or non slotted tags and cylindrical styles. They can therefore be accommodated in almost all makes of wedge contact type fuse carrier.

'J' type fuse links comply with the requirements of BS88: Part 5 and have been ASTA certified for category of duty 415V ac, i.e. 46,000 A rms. symmetrical at 415V.

Type 'J' cylindrical design with ferrule end caps for use in pole or wall mounted outdoor service fuse units. Category of duty 415AC46 Class Q1.

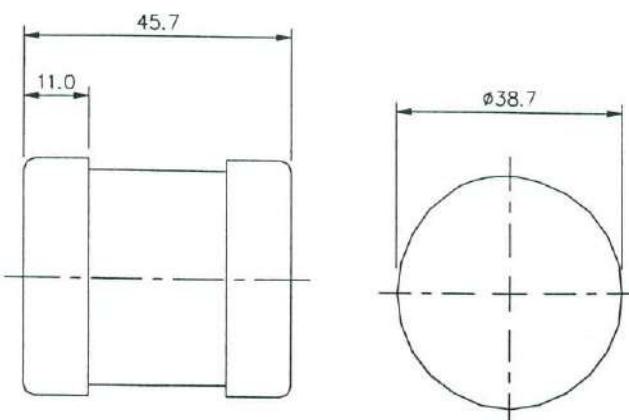
Order Code: Rating + MJ25-6

Ratings (A): 20, 32, 40, 63, 80,
100, 125, 160,
200, 250

Rated Voltage (V): 415 ac

Carton Quantity: 10

Data sheet number: 4177

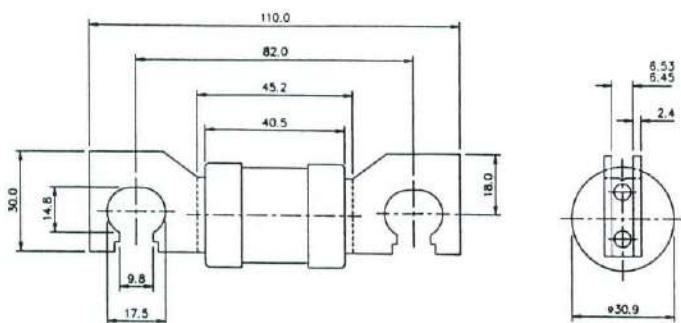


Dimensions in mm

TYPE 'J' SLOTTED

Type 'J' Slotted

Dimensions in mm



Order Code: Rating + MJ30-8

Ratings (A): 32, 40, 50, 63

Rated Voltage (V): 415 ac

Carton Quantity: 10

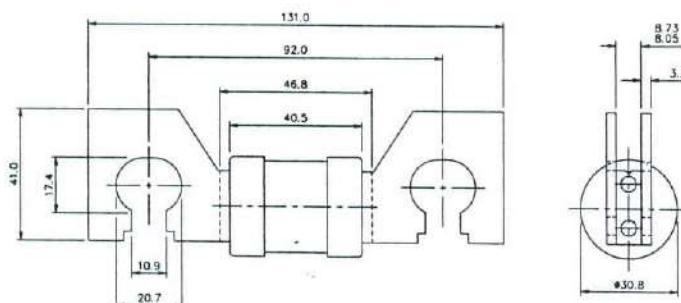
Order Code: Rating + MJ30-7

Ratings (A): 80, 100, 125, 160, 200, 250, 315

Rated Voltage (V): 415 ac

Carton Quantity: 10

Data sheet number: 4178



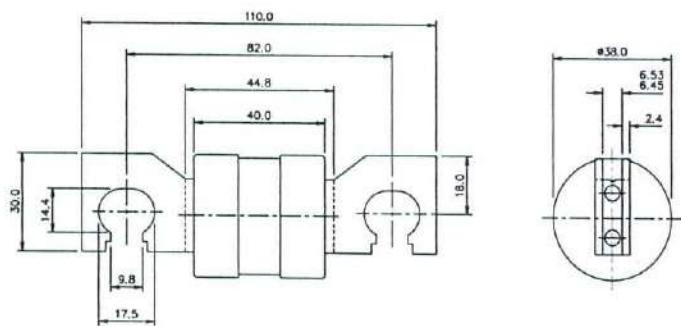
Order Code: Rating + MJ31-7

Ratings (A): 20, 25, 32, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315

Rated Voltage (V): 415 ac

Carton Quantity: 10

Data sheet number: 4180



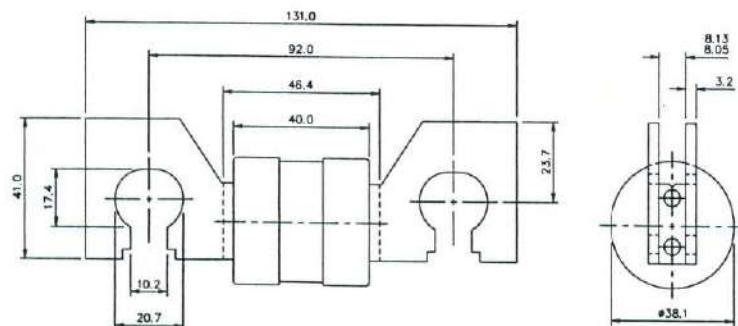
Order Code: Rating + PJ30-7

Ratings (A): 355, 400

Rated Voltage (V): 415 ac

Carton Quantity: 10

Data sheet number: 4179



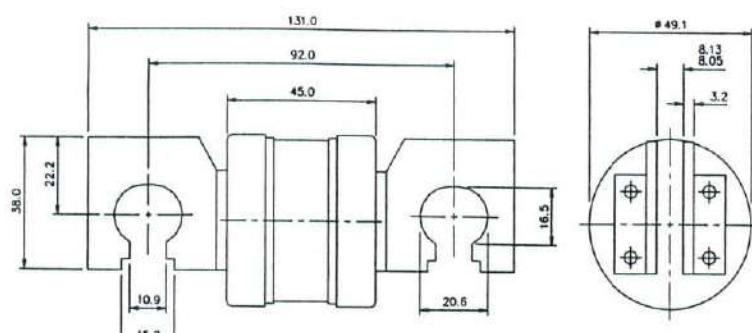
Order Code: Rating + PJ31-7

Ratings (A): 355, 400

Rated Voltage (V): 415 ac

Carton Quantity: 10

Data sheet number: 4181



Order Code: Rating + RJ31-7

Ratings (A): 450, 500

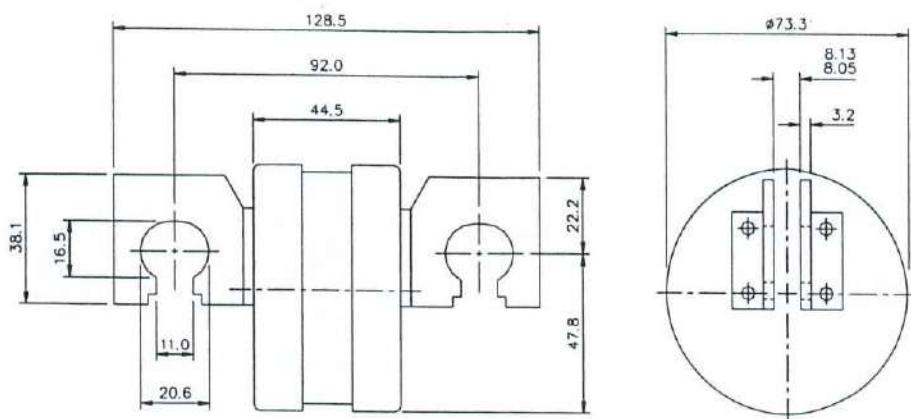
Rated Voltage (V): 415 ac

Carton Quantity: 10

Data sheet number: 4182

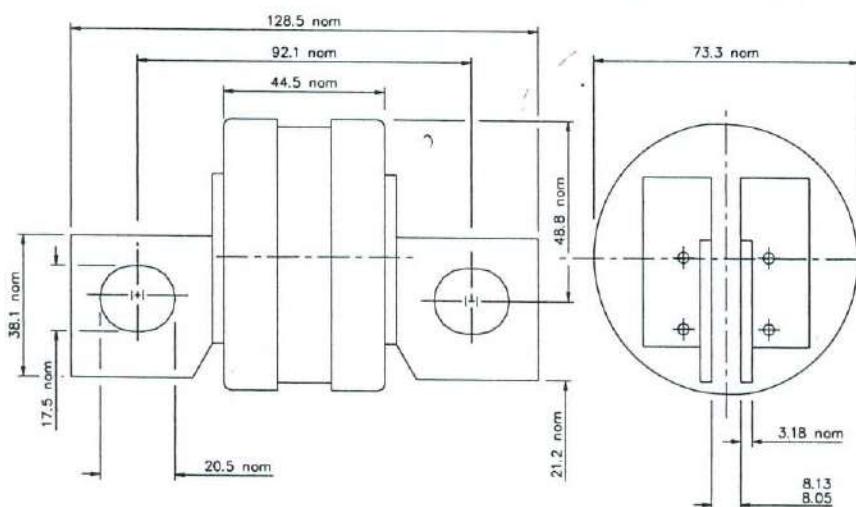
Order Code: Rating + SJ31-6
Ratings (A): 560, 630
Rated Voltage (V): 415 ac
Carton Quantity: 10
Data sheet number: 4183

Type 'J' Slotted
Dimensions in mm



Order Code: Rating + SJ28
Rating (A): 800
Rated Voltage (V): 415 ac
Carton Quantity: 10
Data sheet number: 4184

Type 'J' non-slotted
All dimensions in mm



Consumer Unit Fuse Links

Approved for the protection of incoming supplies to domestic consumer units.

Approved to BS1361. Packed 100 per carton.

Cat. Number.	Rating (A)	Dia. (mm)	Overall Length (mm)	Colour Code
C55	5	5.35	23	White
C1515	15	10.32	26	Blue
C1520	20	10.32	26	Yellow
C3030	30	12.7	29	Red
C4545	45	16.67	35	Green



Order Code: As shown in table left.

Ratings (A): 5, 15, 20, 30, 45

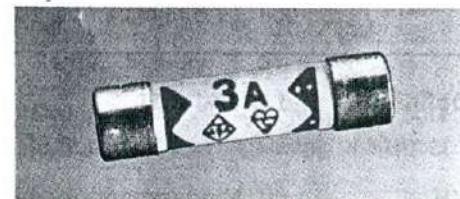
Rated Voltage (V): 240

Carton Quantity: 100

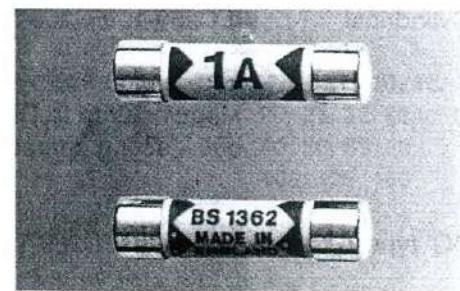
Plug Top Fuse Links

The British domestic system requires that a BS1362 fuse link is fitted into a domestic BS1363 plug-top to conform with the requirements of the Plug and Socket Safety Regulations, 1995. With a BS1362 plug top fuse link, the flexible cable connected to domestic equipment can always be fully protected against the effects of overload or small over currents when correctly fused.

Contact Bussmann for advice on the correct fusing factor to protect domestic appliances.



Cat. Prefix.	Rating (A)	Dia. (mm)	Overall Length (mm)	Colour Code
C180	1	6.4	25.4	Black
	2			Black
	3			Red
	5			Black
	7			Black
	10			Black
	13			Brown



Order Code: C180 + Rating

Ratings (A): 1, 2, 3, 5, 7, 10, 13

Rated Voltage (V): 240

Carton Quantity: 100

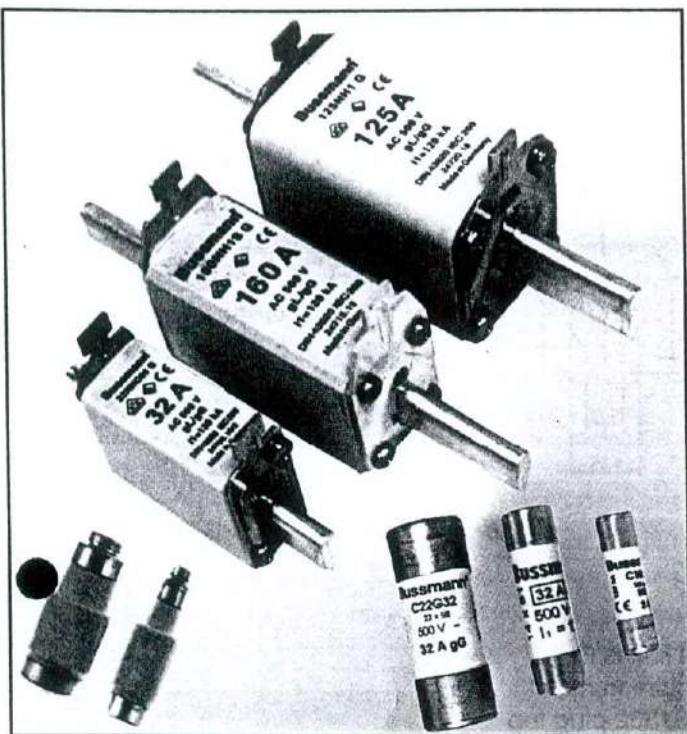
Bussmann Plug Top fuse links carry the BSI Kite Mark.



Bussmann Plug Top fuse links carry ASTA accreditation*.



*Not the 1 Amp



The Bussmann range of DIN dimension fuse links include the NH' blade type for applications up to and including 1600 Amps; for ac circuits operating at levels up to 500 Volts; and dc circuits with voltages up to 440 Volts. Designs with restricted current ratings are available for 660 Volt ac systems.

Cylindrical fuse links with ferrule end caps with ratings up to 125 Amps, for circuits in which the voltages do not exceed 500 Volts.

D' and DO' type fuse links (end contact or screw type).

Definitions and Standards

NH Niederspannungs Hochleistungs (low voltage, high breaking capacity) to IEC269 and VDE 0636/21 (DIN Dimension 43620).

Cylindrical IEC269-1, IEC269-2-1 in body sizes 10.3 x 38 mm, 14 x 51 mm and 22 x 58 mm.

D' type Manufactured to DIN specification 49365 and 49360. they have delayed, quick acting or ultra quick acting characteristics. Conform to VDE regulations 0635.

DO' type Tested to IEC269-1. Suitable for 440 Volt applications.

DIN Standard Deutsche Industrie Norm (German Industry Dimensional Norm).

VDE Standard Verband Deutscher Elektrotechniker (German Electrotechnical Association).

IEC Standard International Electrotechnical Commission - now accepted by most countries world-wide.

Blade Type

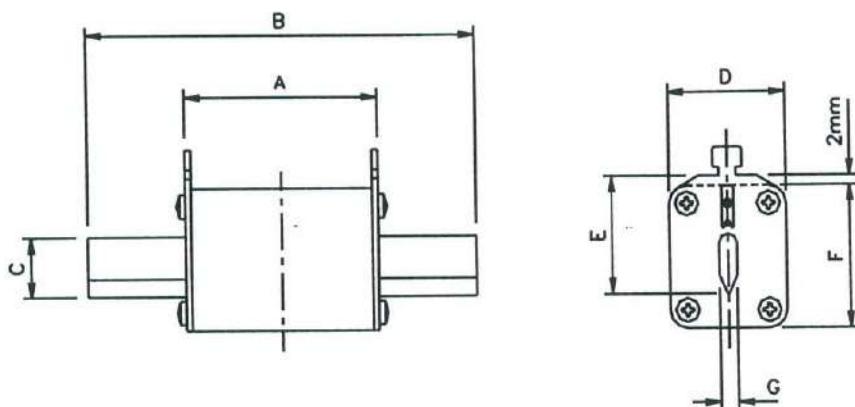
The NH fuse link designs are used in factory distribution systems and in the distribution cabinets of the electricity supply industry, protecting power distribution networks.

Available for applications up to 1600 Amps, for ac circuits operating at levels up to 500 Volts and dc circuits of up to 440 Volts.

Approved to IEC269 and VDE 0636

Dimensions in accordance with DIN 43.620.

NH Fuse Links with gL/gG and aM Classification.

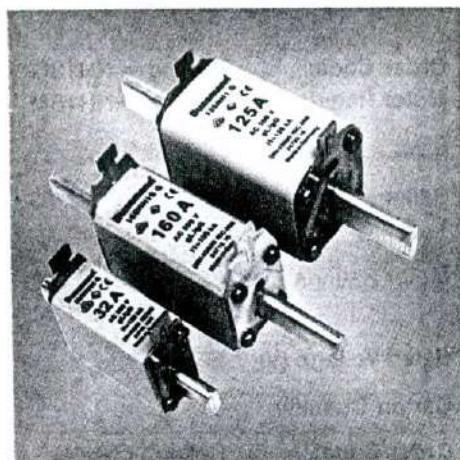


Dimensions in mm

Fuse Size	A	B	C	D	E	F	G
C00	49.0	78.5	15.0	21.0	35.0	41.0	6.0
00	49.0	78.5	15.0	30.0	35.0	48.0	6.0
0	68.0	125.0	15.0	30.0	35.0	48.0	6.0
1 (small)	68.0	135.0	15.0	30.0	40.0	48.0	6.0
1	68.0	135.0	20.0	41.0	40.0	53.0	6.0
2	68.0	150.0	25.0	51.0	48.0	61.0	6.0
3	68.0	150.0	32.0	72.0	60.0	76.0	6.0
4A	90.0	200.0	50.0	100.0	85.0	85.0	6.0

Note: aM fuse links are specially designed for use with Motors. The current rating of the fuse link is taken directly from the full load current of the motor.

e.g. Motor FLC = 60A, fuse link = 63A aM category. (e.g. 63NH00M)



Order Code: Rating + NHC00G

Size: C00

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32, 35, 40, 50, 63, 80, 100

Rated Voltage (V): 500 ac

Carton Quantity: 3

Order Code: Rating + NH00G
Motor Rated: Rating + NH00M

Size: 00

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 32, 35, 40, 50, 63, 80, 100, *125, *160

Motor Ratings (A): 2, 4, 6, 8, 10, 16, 20, 25, 32, 35, 40, 50, 63, 80, 100, 125, 160

Rated Voltage (V): 500 ac

Carton Quantity: 3

Order Code: Rating + NH0G
Motor Rated: Rating + NH0M

Size: 0

Ratings (A): 6, 10, 16, 20, 25, 32, 35, 40, 50, 63, 80, 100, 125, 160

Motor Ratings (A): 6, 10, 16, 20, 25, 32, 35, 40, 50, 63, 80, 100, 125, 160

Rated Voltage (V): 500 ac

Carton Quantity: 3

* rated current not standardised in VDE0636 and IEC269.

NH General Purpose and Motor Protection Fuse Links Bussmann

NH Fuse Links with gL/gG and aM Classification (cont).

Order Code: Rating + NH1SG
Motor Rated: Rating + NH1SM

Size: 1 (Small)

Ratings (A): 25, 32, 35, 40, 50, 63,
80, 100, 125, 160

Motor Ratings (A): 35, 40, 50, 63, 80,
100, 125, 160

Rated Voltage (V): 500 ac

Carton Quantity: 3

Order Code: Rating + NH1G
Motor Rated: Rating + NH1M

Size: 1

Ratings (A): 125, 160, 200, 224, 250

Motor Ratings (A): 200, 224, 250

Rated Voltage (V): 500 ac

Carton Quantity: 3

Order Code: Rating + NH2G
Motor Rated: Rating + NH2M

Size: 2

Ratings (A): 40, 50, 63, 80, 100, 125,
160, 200, 224, 250, *300,
315, *355, 400

Motor Ratings (A): 100, 125, 160,
200, 224, 250,
315, 355, 400

Rated Voltage (V): 500 ac

Carton Quantity: 3

Order Code: Rating + NH3G
Motor Rated: Rating + NH3M

Size: 3

Ratings (A): 315, *355, 400, 500, 630

Motor Ratings (A): 160, 200, 224,
250, 315, 355,
400, 500, 630

Rated Voltage (V): 500 ac

Carton Quantity: 3

Order Code: Rating + NH4AG

Size: 4A

Ratings (A): 800, 1000, 1250,
1600

Rated Voltage (V): 500 ac

Carton Quantity: 3

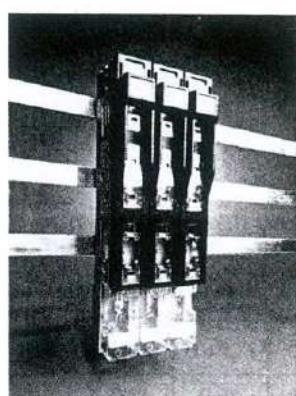
A full range of NH fuse bases, fuse switch disconnectors, switch fuses and vertical fuse switch disconnectors for NH products are available from Bussmann. Please ask for our Fusegear Catalogue which contains details of all our Fusegear products.

Universal fuse pullers (handle) are available for fuse link extraction from the base, catalogue number 630.

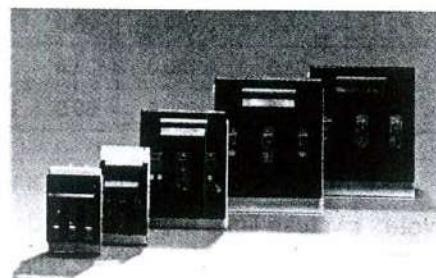
Designs with restricted current ratings at 660 Volts ac, 440 Volts dc, are available to order, please ask for Data Sheet number 4172 for full details.

A range of NH fuse links with insulated tags can be supplied to special order, details on request from our Application Engineers. (See page 1 for useful phone numbers).

For characteristic details and time current curves please see pages 35 to 39.



Vertical Load Break Switch Disconnector.



Fuse Switch Disconnector.

Bussmann square bodied High Speed Fuse Links are tested to IEC269 Part 4 and are UL recognised.
660 Volts ac 10 to 7500 Amps
1250 Volts ac 50 to 1400 Amps

General Information

DIN style fuse links are available with a number of different fixings. Options include:

DIN 43.653

DIN 43.620

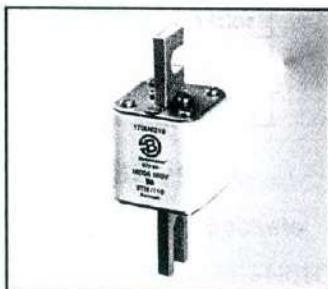
French Style

North American Slotted Blade

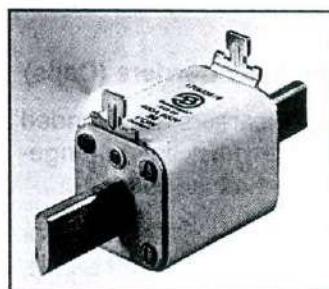
Flush End (metric/USA)

Accessories

Bussmann square bodied fuse links are available with different open fuse indicator systems. Options include visual indication and indication utilising a micro switch. Fuse blocks are also available for most applications.



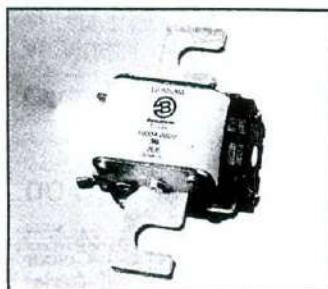
DIN 43.653



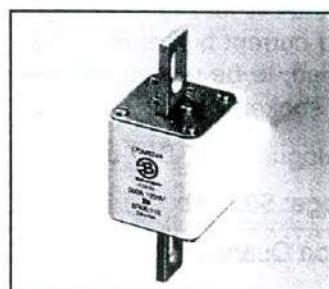
DIN 43.620



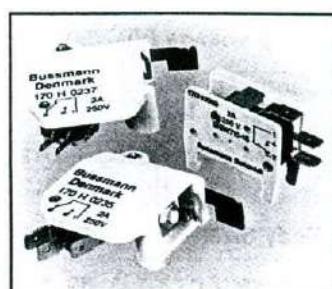
Flush End Contact



French Style

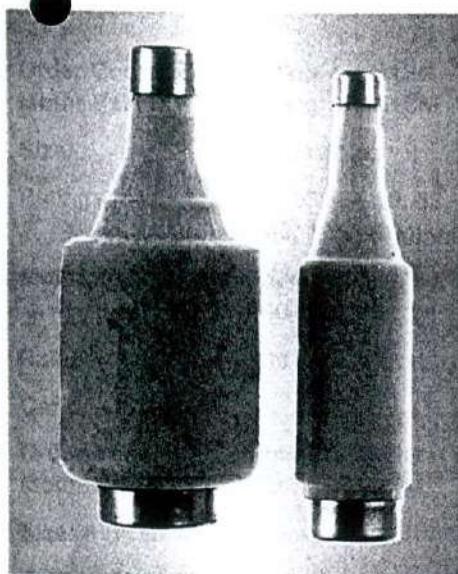


European Style -US Standard



Micro Switches

For further details of these products, please ask for our catalogue on semiconductor protection titled 'High Speed Fuses'.



Quick acting fuse links are used for protection against short circuits and overloads in most circuits.

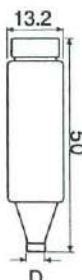
Time Lag fuse links are used for the protection of input motor circuits, in combination with circuit breakers and motor protection switches.

Manufactured to IEC269, DIN 49515

Accessories

D type Fuse Sockets

The Fuse Sockets are intended to fix the complete fuse on the mounting surface. The fuse base accommodates the fuse link and the gauge piece providing connectability for the circuit wiring.



Cat. No.	Dia. 'D' (mm)	Colour Code
2D16	6	Pink
4D16	6	Brown
6D16	6	Green
10D16	8	Red
16D16	10	Grey
20D16	12	Blue
25D16	14	Yellow

Order Code: Rating + D16Q (quick)
Rating + D16 (delay)

Body Size: E16-D1

Ratings (A): 2, 4, 6, 10, 16, 20, 25

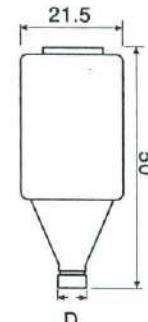
Rated Voltage (V): 500 ac

Carton Quantity: 20

Catalogue Ref. SFD27 and SFD33 for single pole. TFD27 and TFD33 for triple pole.

Voltage: 500V ac

Carton Quantity: 10



Cat. No.	Dia. 'D' (mm)	Colour Code
2D27	6	Pink
4D27	6	Brown
6D27	6	Green
10D27	8	Red
16D27	10	Grey
20D27	12	Blue
25D27	14	Yellow

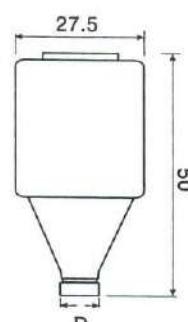
D type Fuse Carriers (Caps)

The fuse carriers are intended to ensure quick interchangeability of the fuse links

Catalogue Ref. CD27 (caps for D11) or CD33 (caps for D111).

Voltage: 500V ac

Carton Quantity: 10



Cat. No.	Dia. 'D' (mm)	Colour Code
35D33	16	Black
50D33	18	White
63D33	20	Copper

D type Gauge Pieces

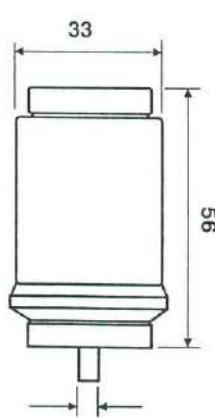
The gauge pieces preclude the possibility of overfusing (i.e. prevent the fuse link, having a rated current higher than prescribed, to be placed into the fuse socket).

Catalogue Ref. GD27 or GD33

Voltage: 500V ac

Carton Quantity: 10

Gauge Piece Key: Catalogue number NZK



Cat. Ref.	Dia. 'D'	Colour Code
80D125	5	Silver
100D125	7	Red

Notes:

When ordering Fuse Sockets, please specify DIN rail or Panel Mounted.

All accessories are non stock items and are supplied to special order only.

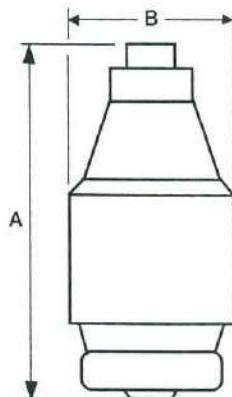
Type DO Fuse Links

Type DO

The design feature of a cooler running fuse link with compact dimensions, giving the advantage in space saving over the D' type.

Manufactured to IEC269 and VDE 0636 Standards

Type	Cat. No.	A	B	Colour Code
DO1	2NZ01	36.0	11.0	Pink
	4NZ01			Brown
	6NZ01			Green
	10NZ01			Red
	16NZ01			Grey
DO2	20NZ02	36.0	15.0	Blue
	25NZ02			Yellow
	35NZ02			Black
	50NZ02			White
	63NZ02			Copper



Order Code: Rating + NZ01

Body Size: E14

Ratings (A): 2, 4, 6, 10, 16

Rated Voltage (V): 400 ac, 250 dc

Carton Quantity: 10

Order Code: Rating + NZ02

Body Size: E18

Ratings (A): 20, 25, 35, 50, 63

Rated Voltage (V): 400 ac, 250 dc

Carton Quantity: 10

Accessories

DO type Fuse Sockets

Catalogue Ref. FN01C (DO1 size) and FN02C (DO2 size) for single pole.

TFN02C (DO2 size) for triple pole.

Voltage: 400V ac

Carton Quantity: 10

DO type Fuse Carriers (Caps)

Catalogue Ref.. CN01 (Caps for DO1); CN02 (Caps for DO2).

Voltage: 400V ac

Carton Quantity: 10

DO type Gauge Pieces

Catalogue Ref. GN01 or GN02

Voltage: 400V ac

Carton Quantity: 10

All accessories are non stock items and are supplied to special order only.



Type D' Ultra Quick

Primarily for the protection of Semiconductor devices, with gR characteristics.
Manufactured to IEC269 and VDE 0636 Standards.

Colour Coding

Order Code: Rating + D16R

Ratings (A): 2, 4, 6, 10, 16, 20, 25

Rated Voltage (V): 500 ac, 315 dc

Carton Quantity: 20

Order Code: Rating + D27R

Ratings (A): 2, 4, 6, 10, 16, 20, 25, 30

Rated Voltage (V): 500 ac, 315 dc

Carton Quantity: 5 For size specification please refer to page 30.

Order Code: Rating + D33R

Ratings (A): 35, 50, 63

Rated Voltage (V): 500 ac, 315 dc

Carton Quantity: 5

Order Code: Rating + D125R

Ratings (A): 80, 100

Rated Voltage (V): 500 ac, 315 dc

Carton Quantity: 10

Catalogue Suffix	Rating	Colour Code
D16R	2	Pink
	4	Brown
	6	Green
	10	Red
	16	Grey
	20	Blue
	25	Yellow
D27R	2	Pink
	4	Brown
	6	Green
	10	Red
	16	Grey
	20	Blue
	25	Yellow
D33R	30	Black
	35	Black
	50	White
D125R	63	Copper
	80	Silver
	100	Red

Type DO' Ultra Quick.

All dimensions in mm

For use in the protection of Semiconductor Devices with gR characteristics. Manufactured to IEC269 and VDE0636 Standards.

Order Code: Rating + NZ01R

Ratings (A): 2, 4, 6, 10, 16

Rated Voltage (V): 400 ac, 250 dc

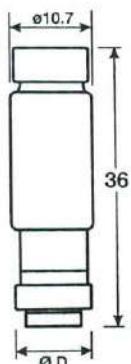
Carton Quantity: 10

Order Code: Rating + NZ02R

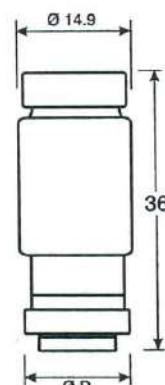
Ratings (A): 20, 35, 50, 63

Rated Voltage (V): 400 ac, 250 dc

Carton Quantity: 10



Type NZ01R



Type NZ02R

Catalogue Number	Diameter (mm)	Colour Code
2NZ01R	7.3	Pink
4NZ01R	7.3	Brown
6NZ01R	7.3	Green
10NZ01R	8.5	Red
16NZ01R	9.7	Grey

Catalogue Number	Diameter (mm)	Colour Code
25NZ02R	12.1	Brown
35NZ02R	13.3	Black
50NZ02R	14.5	White
63NZ02R	15.9	Copper

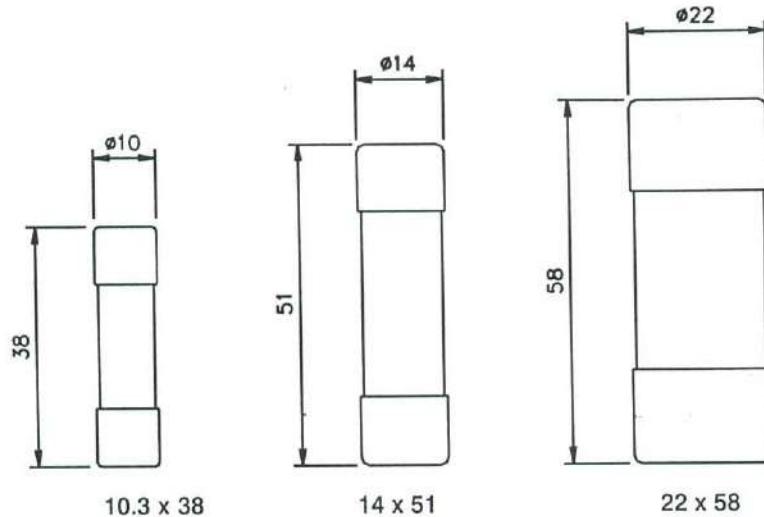
Cylindrical fuse links with Ferrite End Caps

Bossard

Fuse Links for industrial applications (gL / gG) and motor protection (aM). Available in three sizes: 10 x 38, 14 x 51 and 22 x 58 millimetres.

Manufactured to IEC269-1 and IEC269-2-1; NFC63.210, 63.211.

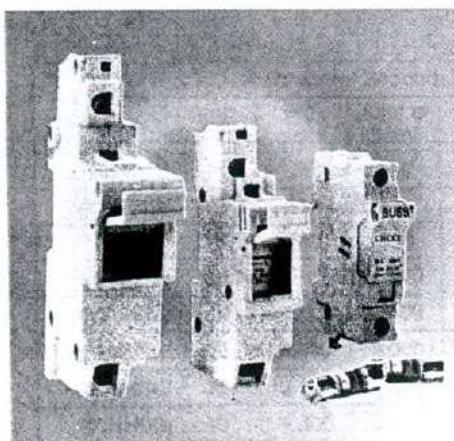
All dimensions in mm.



Cylindrical gL fuse links are for slow/quick fusing; slow for small overcurrents, quick for larger overcurrents (short circuits) and suitable for most types of installations.

Cylindrical aM is specifically used for the protection of motors against short circuit.

A Modular type fuse holder is available for cylindrical fuse links, (picture below) please ask for our Components Catalogue or contact our Application Engineers for details. (See useful phone numbers on page 1).



Order Code: (gL) C10G + Rating
(aM) C10M + Rating

Fuse Size: 10.3 x 38

Ratings (A): 0.5, 1, 2, 4, 6, 8, 10,
12, 16, 20, 25, 32

Motor Ratings (A): As above for gL
except no 32 amp

Rated Voltage (V): 500 ac (400 ac for
32A gL & 25A aM)

Carton Quantity: 10

Order Code: (gL) C14G + Rating
(aM) C14M + Rating

Fuse Size: 14 x 51

Ratings (A): 2, 4, 6, 8, 10, 12, 16,
20, 25, 32, 40, 50

Motor Ratings (A): As above for gL

Rated Voltage (V): 500 ac (400 ac for
50A gL and aM)

Carton Quantity: 10

Order Code: (gL) C22G + Rating
(aM) C22M + Rating

Fuse Size: 22 x 58

Ratings (A): 16, 20, 25, 32, 40,
50, 63, 80, 100, 125

Motor Ratings (A): As above for gL

Rated Voltage (V): 500 ac (400 ac for
125A gL & aM)

Carton Quantity: 10

Neutral Links

Catalogue Reference: C10NL 10 x 38
C14NL 14 x 51
C22NL 22 x 58

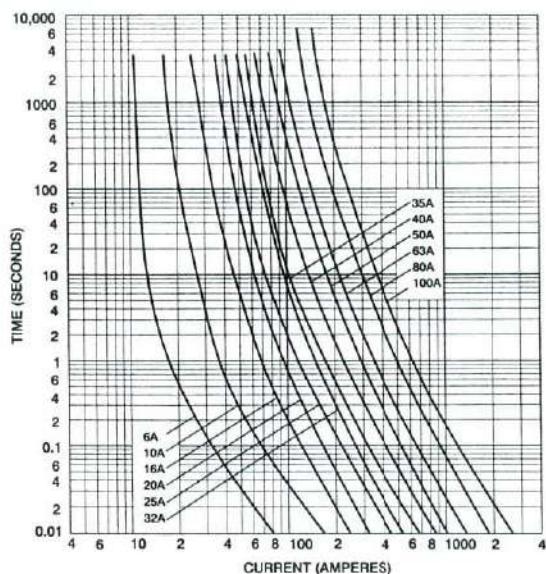
Carton Quantity: 10

Technical Data Sheets on NH Style Fuse Links

www.bussmann.com

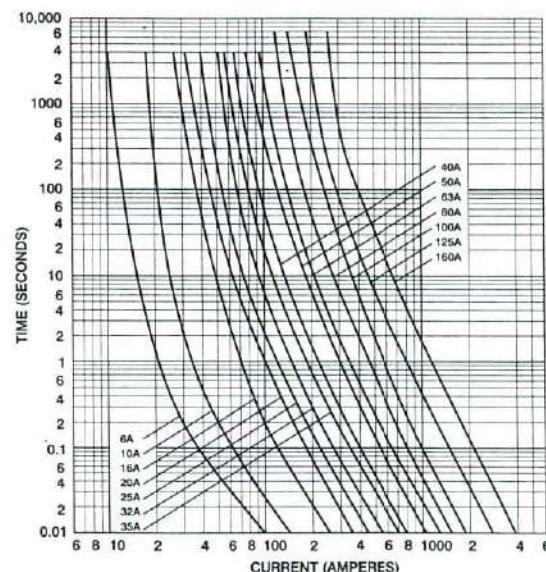
Time Current Characteristics for NH size C00 Fuse Links

Catalogue Number	I ^t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
6NHC00G	6	75	180	390	1.3	500V ac
10NHC00G	10	250	605	1,300	1.5	
16NHC00G	16	350	850	1,850	2.0	
20NHC00G	20	780	1,900	4,200	2.1	
25NHC00G	25	1,400	3,400	7,800	2.3	
32NHC00G	32	2,000	5,000	11,000	3.5	
35NHC00G	35	3,100	6,500	14,000	3.5	
40NHC00G	40	4,300	8,700	20,000	3.8	
50NHC00G	50	6,000	13,100	30,000	4.4	
63NHC00G	63	9,900	21,000	55,000	5.4	
80NHC00G	80	14,000	34,000	80,000	5.4	
100NHC00G	100	23,000	51,000	110,000	6.4	



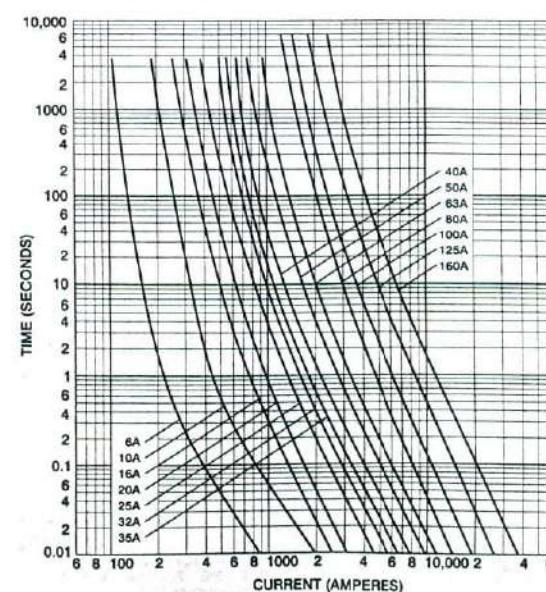
Time Current Characteristics for NH' size 00 Fuse Links

Catalogue Number	I ^t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
6NH00G	6	76	180	390	1.3	500V ac
10NH00G	10	250	605	1,300	1.6	
16NH00G	16	350	850	1,850	2.0	
20NH00G	20	780	1,900	4,200	2.1	
25NH00G	25	1,400	3,400	7,800	2.3	
32NH00G	32	2,000	5,000	11,000	3.5	
35NH00G	35	3,100	6,500	14,000	3.5	
40NH00G	40	4,300	8,700	20,000	3.8	
50NH00G	50	6,000	13,100	30,000	4.8	
63NH00G	63	9,900	21,000	55,000	5.6	
80NH00G	80	14,000	34,000	80,000	6.8	
100NH00G	100	25,000	51,000	110,000	7.3	
125NH00G	125	40,500	96,000	214,000	9.2	
160NH00G	160	76,500	178,000	405,000	11.7	



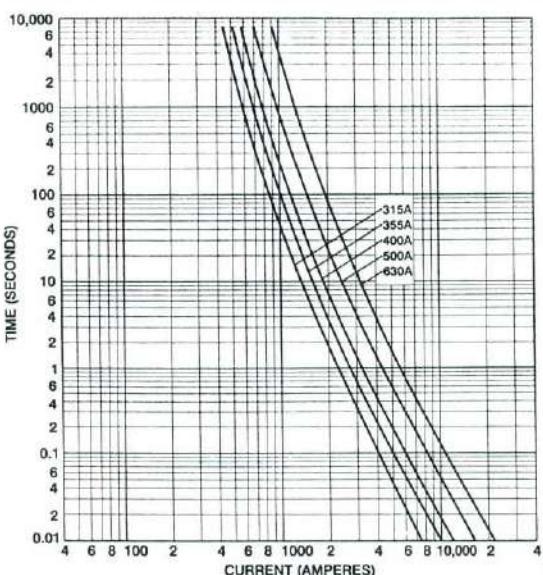
Time Current Characteristics for NH' size 0 Fuse Links

Catalogue Number	I ^t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
6NH0G	6	75	180	390	1.8	500V ac
10NH0G	10	250	605	1,300	2.1	
16NH0G	16	350	850	1,850	2.5	
20NH0G	20	780	1,900	4,200	2.7	
25NH0G	25	1,400	3,400	7,800	3.0	
32NH0G	32	2,000	5,000	11,000	4.2	
35NH0G	35	3,100	6,500	14,000	4.3	
40NH0G	40	4,300	8,700	20,000	4.6	
50NH0G	50	6,000	13,100	30,000	5.5	
63NH0G	63	9,900	21,000	55,000	7.2	
80NH0G	80	14,000	34,000	80,000	7.3	
100NH0G	100	23,000	51,000	110,000	9.4	
125NH0G	125	40,500	96,000	214,000	12.6	
160NH0G	160	76,500	178,000	405,000	14.2	



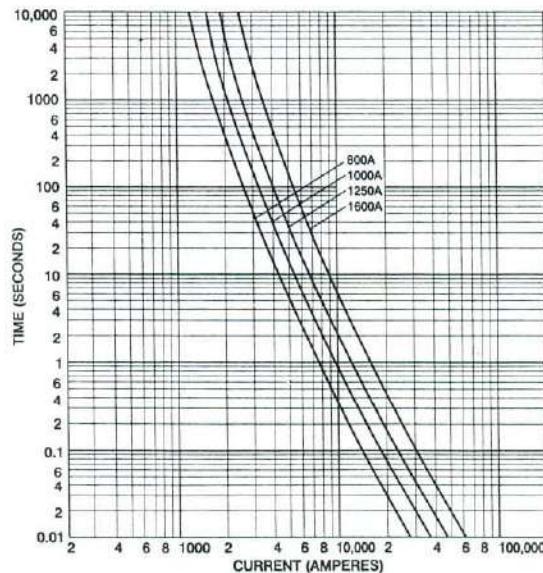
Time Current Characteristics for NH' Size 3 Fuse Links

Catalogue Number	I ² t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
315NH3G	315	320,000	780,000	1,750,000	32.2	500V ac
355NH3G	355	405,000	1,000,000	2,250,000	37.9	
400NH3G	400	590,000	1,500,000	3,300,000	38.6	
500NH3G	500	1,000,000	2,500,000	5,500,000	38.3	
630NH3G	630	1,670,000	4,100,000	9,200,000	42.5	



Time Current Characteristics for NH' Size 4a Fuse Links

Catalogue Number	I ² t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
800NH4AG	800	3,700,000	8,400,000	17,700,000	68.0	500V ac
1000NH4AG	1000	5,600,000	13,300,000	30,300,000	72.5	
1250NH4AG	1250	12,260,000	30,300,000	65,300,000	98.5	
1600NH4AG	1600	20,500,000	50,000,000	109,000,000	126.0	

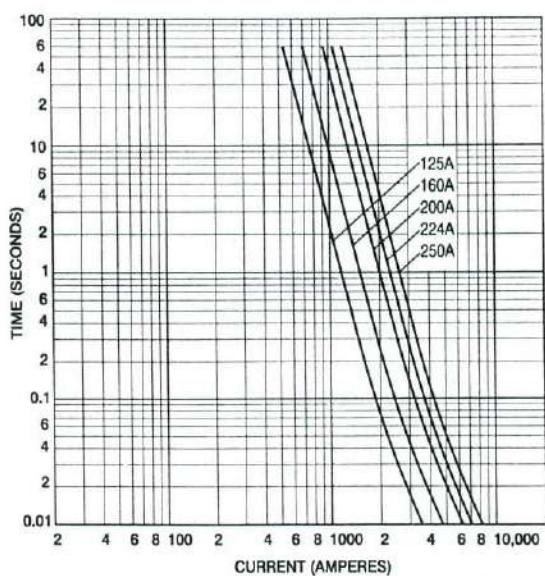


TIME-DIVIDED EXPONENTIAL CIRCUIT BREAKER-STYLE FUSE LINKS

BOB SMC 100

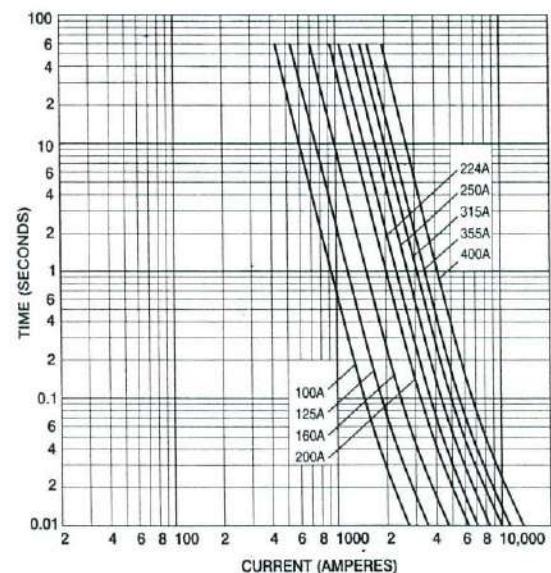
Time Current Characteristics for NH' aM Size 1 Fuse Links

Catalogue Number	I ² t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
125NH1M	125	70,500	110,800	160,000	6.8	500V ac
160NH1M	160	106,500	165,000	240,000	12.4	
200NH1M	200	180,500	290,000	422,000	15.6	
224NH1M	224	271,000	430,000	610,500	16.5	
250NH1M	250	350,500	563,000	800,000	17.5	



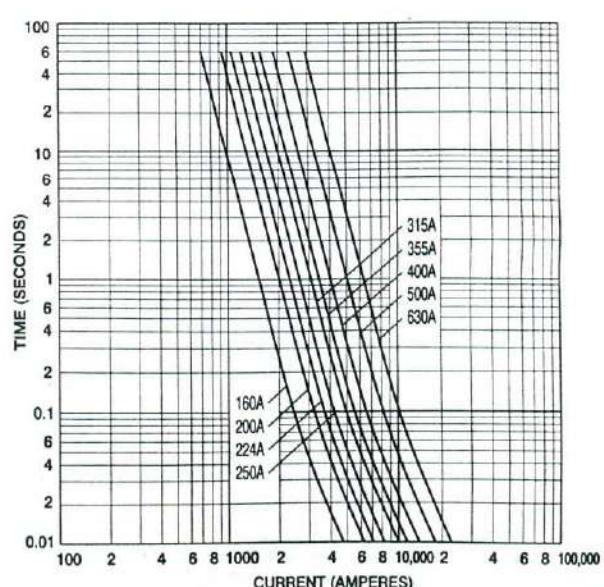
Time Current Characteristics for NH' aM Size 2 Fuse Links

Catalogue Number	I ² t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
100NH2M	100	40,500	65,000	94,000	6.8	500V ac
125NH2M	125	70,500	110,800	160,000	8.5	
160NH2M	160	106,500	165,000	240,000	12.6	
200NH2M	200	180,500	290,000	422,000	15.6	
224NH2M	224	271,000	430,000	610,500	16.5	
250NH2M	250	350,500	563,000	800,000	17.5	
315NH2M	315	500,000	800,000	1,100,000	23.0	
355NH2M	355	620,000	980,000	1,400,000	24.5	
400NH2M	400	750,000	1,150,000	1,600,000	26.0	



Time Current Characteristics for NH' aM Size 3 Fuse Links

Catalogue Number	I ² t (Ampere ² Seconds)				Nom. Watts Loss	Rated Voltage
	Amp Ratings	Pre-Arcing	Total at 380V	Total at 500V		
160NH3M	160	106,500	165,000	240,000	12.6	500V ac
200NH3M	200	180,500	290,000	422,000	15.6	
224NH3M	224	271,000	430,000	610,500	16.5	
250NH3M	250	350,500	563,000	800,000	17.5	
315NH3M	315	500,000	800,000	1,100,000	23.0	
355NH3M	355	620,000	980,000	1,400,000	24.5	
400NH3M	400	750,000	1,150,000	1,600,000	26.0	
500NH3M	500	750,000	1,150,000	1,600,000	33.0	
630NH3M	630	1,350,000	2,200,000	3,100,000	39.0	





Types: LP-CC and FNQ-R Time Delay, current limiting, rejection type fuse links. Physical size 10.3 x 38.1 mm.

Standard 248-4, Class CC; UL Listed, guide JDDZ, File E4273; CSA Certified, Class 1422-01, File 53787 (KTK-R 1422-02.)

Breaking Capacity:

LP-CC - 200,000A rms sym., 20,000A dc
FNQ-R & KTK-R - 200,000A rms sym.



Order Code: LP-CC + Rating

Type: Low Peak® Time Delay.
Current limiting, rejection type. Branch Circuit Fuse.

Ratings (A): 0.5, 0.6, 0.8, 1, 1.125, 1.25,
1.4, 1.5, 1.6, 1.8, 2, 2.25,
2.5, 2.8, 3, 3.2, 3.5, 4, 4.5,
5, 5.6, 6, 6.25, 7, 7.5, 8, 9,
10, 12, 15, 20, 25, 30

Rated Voltage (V): 600 ac, 300 dc (0.5 to
2.8A & 20 to 30A)

Carton Quantity: 10



Order Code: FNQ-R + Rating

Type: Time Delay, Rejection type,
Branch Circuit Fuse

Ratings (A): 0.25, 0.3, 0.4, 0.5, 0.6, 0.75,
0.8, 1, 1.125, 1.25, 1.3, 1.4,
1.5, 1.6, 1.8, 2, 2.25, 2.8, 3,
3.2, 3.5, 4, 5, 6, 6.25, 7.5, 8,
9, 10

Rated Voltage (V): 600 ac

Carton Quantity: 10



Order Code: KTK-R + Rating

Type: Fast Acting, Branch Circuit
fuse. Rejection feature.

Ratings (A): 0.1, 0.125, 0.2, 0.25, 0.3,
0.4, 0.5, 0.6, 0.75, 1, 1.5, 2,
2.5, 3, 3.5, 4, 5, 6, 6, 8, 9,
10, 12, 15, 20, 25, 30

Rated Voltage (V): 600 ac

Carton Quantity: 10

Types: FNQ, FNM, KTQ Time Delay.

Physical size - FNQ & FNM - 10.3 x 38.1mm
KTQ - 10.3 x 34.9mm

Standard 248-14, UL Listings: FNQ & FNM guide JDYX, File E19180; UL Recognised: KTQ 4 to 6 amp, guide JDYX2, File E19180; CSA Certified: FNQ all ratings and FNM 1 to 10 amp 250 volt and 12 to 15 amp 125 volt , Class 1422-01, File 53787.

Breaking Capacity: FNQ, KTQ - 10,000A

FNM - please ask for Data
sheet number 2028



Order Code: FNQ + Rating

Type: Tron® Time Delay

Ratings (A): 0.1, 0.125, 0.15, 0.19, 0.2,
0.25, 0.3, 0.4, 0.5, 0.6, 0.8,
1, 1.125, 1.25, 1.5, 1.6, 2,
2.25, 2.5, 3, 3.2, 3.5, 4, 4.5,
5, 5.6, 6, 6.25, 7, 8, 9, 10,
12, 14, 15, 20, 25, 30

Rated Voltage (V): 500 ac

Carton Quantity: 10



Order Code: FNM +, Rating

Type: Fusetron® Time Delay

Ratings (A): 0.1, 0.125, 0.15, 0.2, 0.25,
0.3, 0.4, 0.5, 0.6, 0.75, 0.8,
1, 1.125, 1.25, 1.4, 1.5, 1.6,
1.8, 2, 2.25, 2.5, 2.8, 3, 3.2,
3.5, 4, 4.5, 5, 5.6, 6, 6.25, 7,
8, 9, 10

Rated Voltage (V): 250 ac

Carton Quantity: 10

Order Code: KTQ + Rating

Type: Time Delay

Ratings (A): 1, 1.6, 2, 3, 4, 5, 6

Rated Voltage (V): 600 ac

Carton Quantity: 10

Dual Element Time Delay & Fast Acting

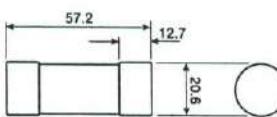
Bussmann

LPJ-SP and JKS are both part of a range of compact dimensioned fuse links providing the same high performance and all purpose protection as the RK-1 Low Peak® Range.

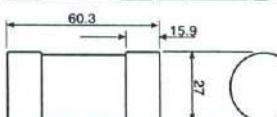
LPJ-SP is UL Listed - special purpose, guide JFHR, file E56412; CSA Certified Class J per CSA-22.2 No. 248.8, class 1422-02, file 53787. It has a breaking capacity of 300,000A rms sym. (UL).

JKS is UL Listed, guide JDDZ, file E4273; CSA Certified, class 1422-02, file 53787. It has a breaking capacity of 200,000A rms sym.

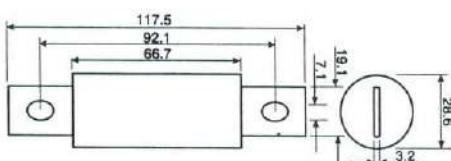
All dimensions in mm



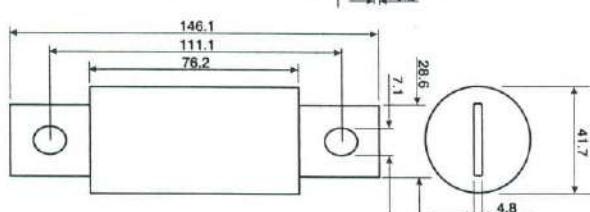
1A to 30A



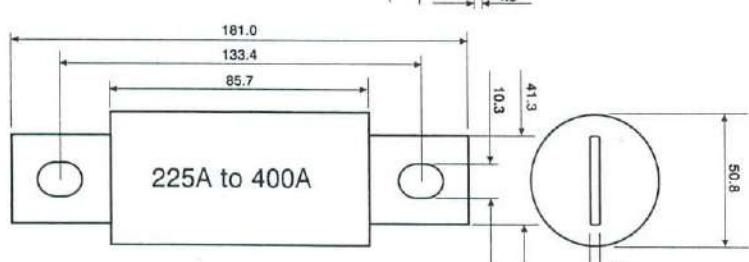
35A to 60A



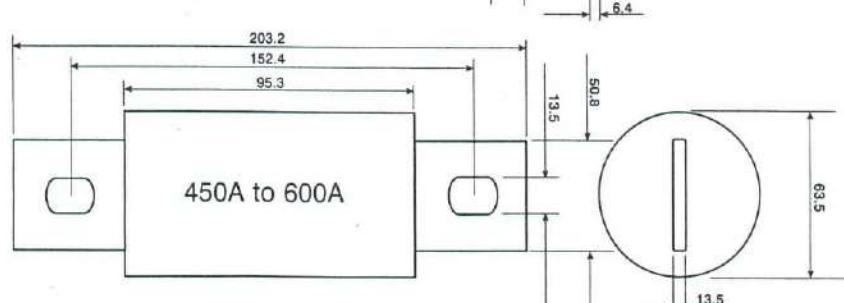
65A to 100A



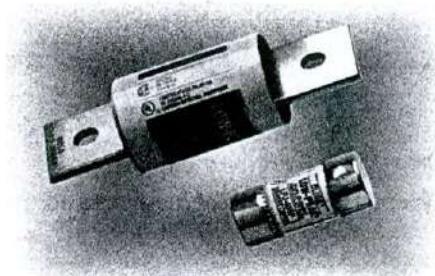
110A to 200A



225A to 400A



450A to 600A



Order Code: LPJ-SP + Rating

Type: Dual Element, Time Delay.

Ratings (A): 1, 1.25, 1.8, 2, 2.25, 2.5, 2.6, 2.8, 3, 3.2, 3.5, 4, 4.5, 5, 5.6, 6, 7, 8, 9, 10, 12, 15, 17.5, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600

Rated Voltage (V): 600 ac; 300 dc

Carton Quantities: 10 - 1 - 60A
5 - 70-200A
1 - 225-600A



Order Code: JKS + Rating

Type: Limitron® Fast Acting

Ratings (A): 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600

Rated Voltage (V): 600 ac

Carton Quantities: 10 - 1 - 60A
5 - 70-100A
1 - 110-600A

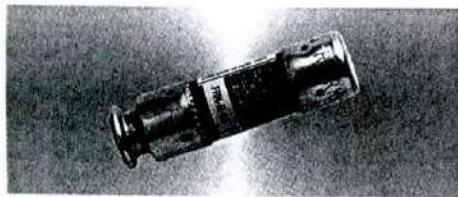
Further information can be obtained for the LPJ-SP from data sheet numbers 1006 and 1007 and for the JKS from 1026 and 1027, both available from Bussmann Application Engineers.

Fusetron® Dual Element Time Delay

Fusetron® Dual Element Time Delay fuse links provide motor overload and short-circuit protection.

Both FRN-R and FRS-R are UL listed, guide JDDZ, file E4273; CSA Certified, class 1422-01, file 53787.

Class R Fuse Blocks 250V and 600V are suitable for the FRN-R and FRS-R respectively.



Order Code: FRN-R + Rating

Type: Dual Element, Time Delay 10 seconds (minimum) at 500% rated current.

Ratings (A): 0.1, 0.125, 0.15, 0.2, 0.25, 0.3, 0.4, 0.5, 0.6, 0.8, 1, 1.125, 1.25, 1.4, 1.5, 1.6, 1.8, 2, 2.25, 2.5, 2.8, 3, 3.2, 3.5, 4, 4.5, 5, 5.6, 6, 6.25, 7, 7.5, 8, 9, 10, 12, 15, 17.5, 20, 25, 30, 35, 40, 45, 50, 60, 70, 75, 80, 85, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600

Rated Voltage (V): 250 ac, 125 dc

Carton Quantities: 10 - 0-60A
5 - 70-100A
1 - 101-600A



Order Code: FRS-R + Rating

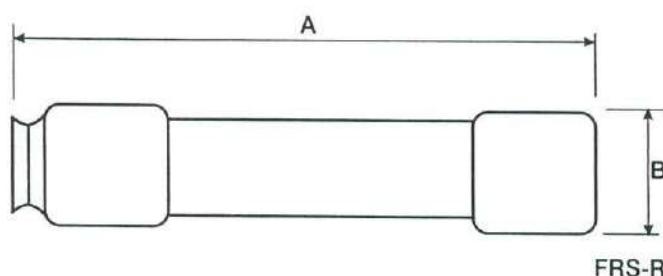
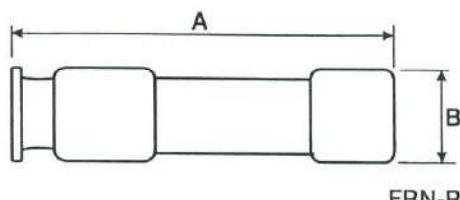
Type: Dual Element, Time Delay 10 seconds (minimum) at 500% rated current.

Ratings (A): 0.1, 0.125, 0.15, 0.2, 0.25, 0.3, 0.4, 0.5, 0.6, 0.8, 1, 1.125, 1.25, 1.4, 1.5, 1.6, 1.8, 2, 2.25, 2.5, 2.8, 3, 3.2, 3.5, 4, 4.5, 5, 5.6, 6, 6.25, 7, 7.5, 8, 9, 10, 12, 15, 17.5, 20, 25, 30, 35, 40, 45, 50, 60, 70, 75, 80, 85, 90, 100, 110, 125, 135, 150, 175, 200, 225, 250, 275, 300, 325, 350, 400, 450, 500, 600

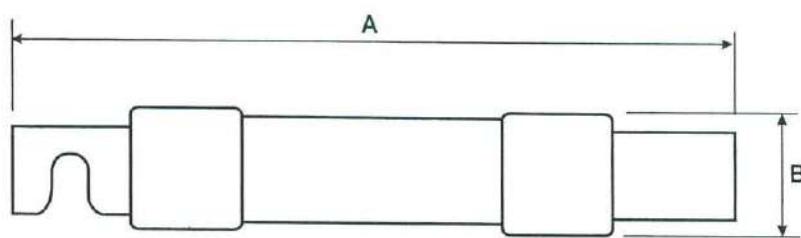
Rated Voltage (V): 600 ac, 300 dc

Carton Quantities: 10 - 0-60A
1 - 70-600A

All dimensions in mm



Rating (A)	FRN-R 250 Volt		FRS-R 600 Volt	
	A	B	A	B
0.1 to 30	50.8	14.3	127.0	20.6
35 - 60	76.2	20.6	139.7	27.0



Rating (A)	FRN-R 250 Volt		FRS-R 600 Volt	
	A	B	A	B
70 to 100	149.2	26.9	200.0	34.0
110 to 200	181.0	39.6	244.5	46.7
225 to 400	219.1	52.3	295.3	65.8
450 to 600	263.5	65.8	339.7	79.5

Further information can be obtained from data sheet numbers 1019 and 1020 for FRN-R and 1017 and 1018 for FRS-R.

Dual Element

Bussmann

KRP-C-SP, KRP-CL-SP, for overload and short circuit protection of high capacity systems.

LPN-RK-SP, LPS-RK-SP, high performance all-purpose fuse links providing a high degree of short circuit protection.

KLU provides a ten second time delay (minimum) at 500% of Amp rating.

Fast Acting

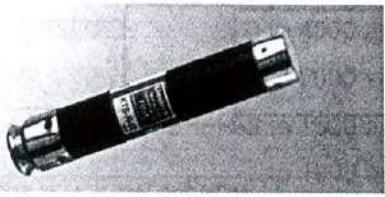
Order Code: KTU + Rating

Type: Limitron® Class L fuse link, Fast Acting Centre Bolted Tag.

Ratings (A): 601, 650, 700, 750, 800, 850, 900, 1000, 1200, 1350, 1400, 1500, 1600, 1800, 2000, 2001, 2500, 3000, 3500, 4000, 4500, 5000, 6000

Rated Voltage (V): 600 ac

Carton Quantity: 1



Order Code: KTS-R or KTN-R + Rating

Types: Limitron® Fast Acting fuse links.

Ratings (A): 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 75, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600

Rated Voltage (V): KTN-R - 250 ac
KTS-R - 600 ac (contact Bussmann for dc ratings).

Carton Quantities: 10 - 1-60A
5 - 70-100A
1 - 110-600A

Approvals for KTS-R and KTN-R:

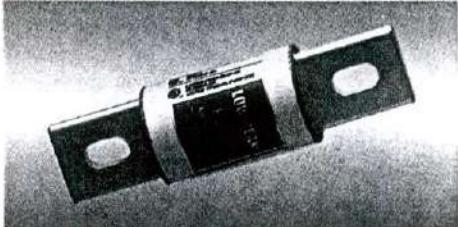
UL Listed, guide JDDZ, file E54273; CSA Certified, class 1422-02, file 53787.

Please ask for data sheets 1043 for KTN-R and 1044 for KTS-R which give full dimensional details.

Approvals for KLU: UL Listed, guide JDDZ, file E4273; CSA Certified, CSA Class 1422-02, file 53787.

Please ask for data sheet number 1013 for dimensional detail.

Time Delay Fuse Links



Order Code: KRP-C-Rating SP

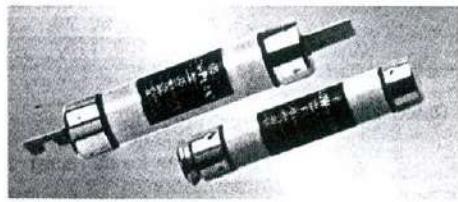
Type: Low Peak Yellow™ Time Delay (minimum 4 seconds at 5 times amp rating for close sizing).

Ratings (A): 601, 650, 700, 750, 800, 900, 1000, 1200, 1350, 1400, 1500, 1600, 1800, 2000, 2500, 3000, 3500, 4000, 4500, 6000

Rated Voltage (V): 600 ac

Carton Quantity: 1

Note: Use KRP-CL for current ratings below 601A



Order Code: LPN-RK-Rating

Type: Low Peak® Dual Element Time Delay.

Ratings (A): 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.6, 0.8, 1, 1.125, 1.25, 1.4, 1.6, 1.8, 2, 2.25, 2.5, 2.8, 3, 3.2, 3.5, 4, 4.5, 5, 5.6, 6, 6.25, 8, 9, 10, 12, 15, 17.5, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 300, 350, 400, 450, 500, 600

Rated Voltage (V): LPN - 250 ac; 125 dc

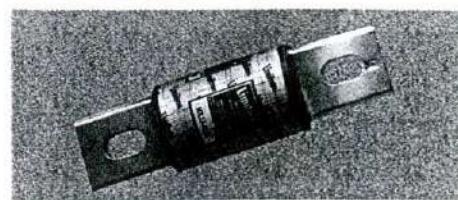
Carton Quantities: 10 - 0.1-60A
5 - 70-100A
1 - 110-600A

Order Code: LPS-RK-Rating

Ratings (A): As above minus 0.15 and 0.2, plus the addition of 7A

Rated Voltage (V): 600 ac, 300 dc

Carton Quantities: As above.



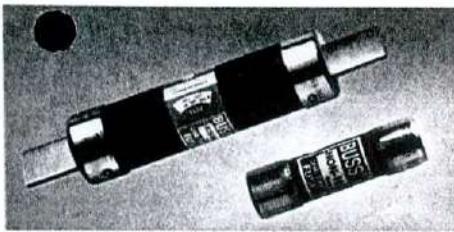
Order Code: KLU + Rating

Type: Limitron® Time Delay

Ratings (A): 601, 650, 700, 800, 1000, 1200, 1500, 1600, 1800, 2000, 2500, 3000, 4000

Rated Voltage (V): 600 ac

Carton Quantity: 1



Approvals: UL Listed - 250V, class K5 (0-60A) Std. 248-9; Class H (70-660A Std. 248-6); 600V, class K5 (15-60A) Std. 248-9; Class H (0-12A, 70-600A) Std. 248-6, guide JDDZ, file E4274. CSA Class 1421-01, file 53787. For further details ask for data sheet number 1030.

Order Code: NOS or NON + Rating

Type: One-time General Purpose Fuse Links

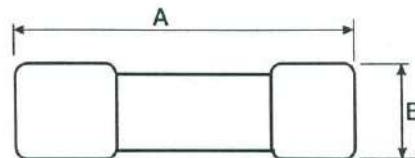
Ratings NON (A): 0.125, 0.5, 0.75, 0.8, 1, 1.25, 1.5, 1.6, 2, 2.5, 3, 3.2, 4, 5, 6, 6.25, 6, 8, 9, 10, 12, 15, 20, 25, 30, 35, 40, 45, 50, 60, 65, 70, 75, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600

Ratings NOS (A): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 75, 80, 90, 100, 110, 125, 150, 175

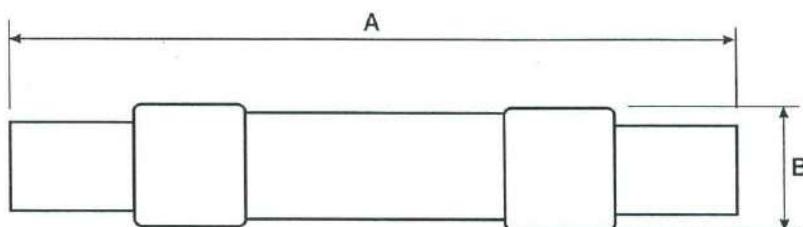
Rated Voltage (V): NON - 250 ac
NOS - 600 ac (contact Bussmann for dc rating information).

Carton Quantities: Refer to Bussmann

All dimensions in mm



Rating (A)	NON 250 Volt		NOS 600 Volt	
	A	B	A	B
0.1 to 30	50.8	14.3	127.0	20.6
35 - 60	76.2	20.6	139.7	27.0



Rating (A)	NON 250 Volt		NOS 600 Volt	
	A	B	A	B
70 to 100	149.2	26.9	200.0	34.0
110 to 200	181.0	39.6	244.5	46.7
225 to 400	219.1	52.3	295.3	65.8
450 to 600	263.5	65.8	339.7	79.5

Bussmann offer a complete range of North American blade and flush end style fuse links plus accessories. The design and construction are optimised to provide:

- Low Energy let-through (I^2t)
- Low Watts Loss
- Superior Cycling Capability
- Low Arc Voltage
- Excellent DC Performance

North American style fuse links provide an excellent solution for medium power applications. While there are currently no published standards for these fuse links, the industry has standardised on mounting centres that accept Bussmann fuse links.

All Bussmann North American style fuse links are certified for their rated voltage. The factory should be consulted for applications exceeding these values.

External and internal open fuse indication is available for a selection of the North American range. Fuse blocks are available for most applications.

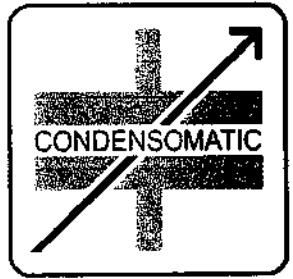
The following range is available:

150 Volts ac/dc	-	70 to 4000 amps
250 Volts ac/dc	-	35 to 2000 amps
500 Volts ac/dc	-	35 to 1600 amps
600 Volts ac	-	1 to 1000 amps
700 Volts ac/dc	-	35 to 1200 amps
800 Volts dc	-	40 to 500 amps
1000 Volts ac	-	40 to 2000 amps

For more comprehensive details of our range of North American Fuse Links for the protection of Semiconductor devices, please ask for our Semiconductor Catalogue.



B



Operating manual

CONDENSOMATIC 2000

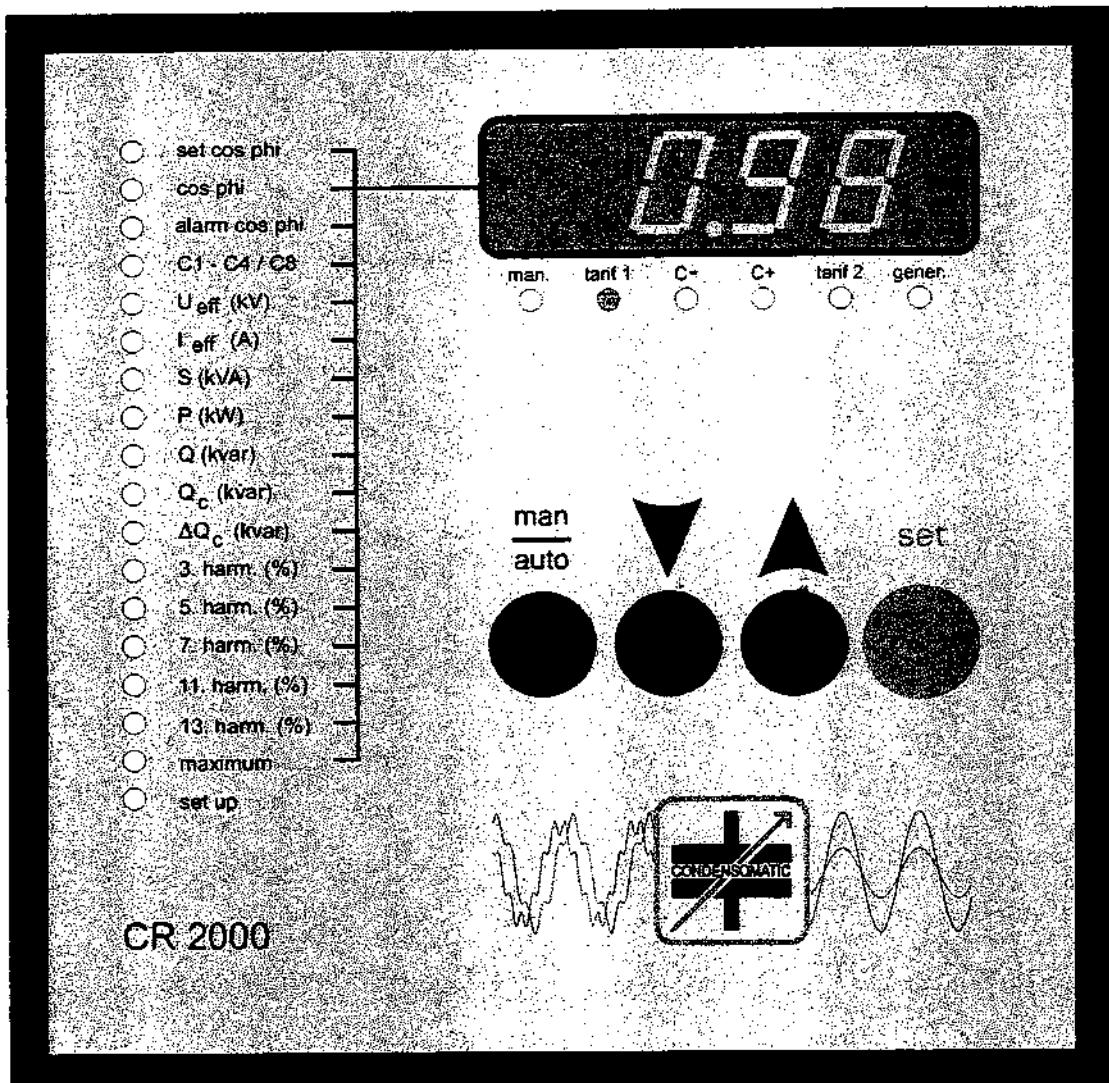


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1. Safety advices

Mounting, connection, setting into operation and repairing of the power factor regulator CONDENSOMATIC 2000 are only allowed to qualified personnel. The valid legal and safety regulations have to be obeyed. Die Bedienungs- und Sicherheitshinweise sowie die technischen Angaben in dieser Bedienungsanleitung und auf dem Typenschild sind zu beachten.

In the case of visible damages or if any invisible damage has to be assumed due to faulty operation or surrounding conditions, the regulator must not be installed or put into operation, that means it has to be stopped immediately.

The regulator works with mains voltage and must not be opened.

The switching outputs are alive in switched off condition, too.

Additionally the safety advices and the operating manual of the power factor correction equipment have to be considered.

2. Features

The power factor regulator CONDENSOMATIC 2000 is designed for application in automatic power factor correction equipments for the load-depending control of power capacitors by means of special capacitor contactors.

After putting into operation the regulator determines the kind of connection. This makes the connection to any phase and any current direction possible. The connected capacitor powers are determined by trial switchings. They are continuously surveyed and corrected during operation.

The CONDENSOMATIC 2000 uses a 4-quadrant measuring system and calculates load-depending the required capacitor power to reach the programmed target-cosphi. This is obtained by switching on and off specific capacitor steps. The load-depending calculation of the switching time and the equal distribution of switchings and operating hours on capacitor steps of equal power minimizes wear and load of the supply system.

The displaying of all important data of the supply system and the power factor correction equipment offers good overview on the situation in the supply system at all times.

The continuous surveillance of data of supply system and power factor correction equipment together with alarms and, if needed, switching off of capacitor steps gives safety against disturbances and overload conditions.

The CONDENSOMATIC 2000 is equipped with an output for external alarm signalling and with an input for tariff switching (optional for CR2000B).

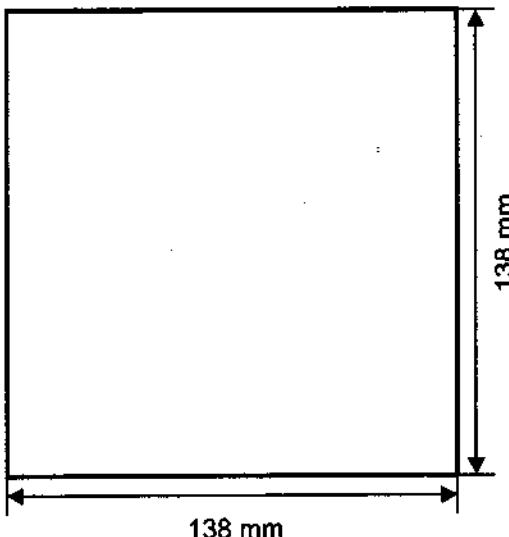
Optional a RS485-interface for communication with the remote control unit FK2000 or a PC is available (not CR2000B).

3. Mounting and installation

The power factor regulator CONDENSOMATIC 2000 is equipped with a case for switchboard mounting according to DIN 43700. The fixing is done with the preassembled panel clips or optional by mounting on a DIN-rail.

The scope of delivery includes pluggable connection blocks for connection.

3.1 switchboard cut

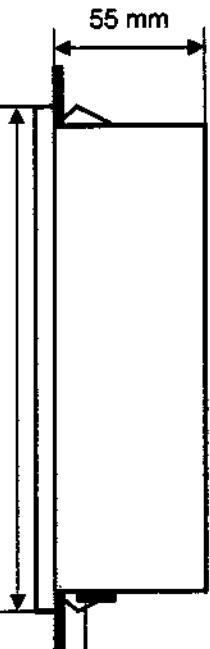


mounting depth

without interface

55 mm

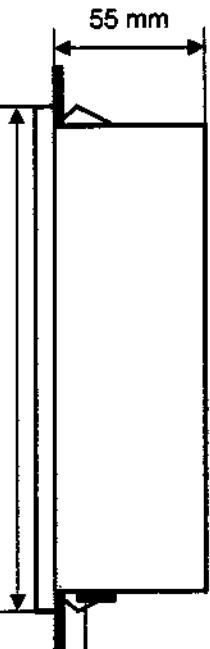
\square 144 mm x 144 mm



with interface

75 mm

min. 1.5 mm



3.2 Connection

The connection of the CONDENSOMATIC 2000 is done with a pluggable connection block. During the installation the technical information on data sheet and rating plate have to be compared with the data of the supply system. Before disconnection of the connection block, all terminals must be checked to be dead and all measuring current circuits have to be bridged.

3.3 Operating voltage

The connection of the operating voltage U_B is made to the terminals 8 and 9. The operating voltage is 230 V / 50 - 60 Hz, if no other rating is given on the rating plate, and has to be fused with a maximum of 4 A.

3.4 Measuring voltage

The measuring voltage U_M has to be connected to the terminals 1 and 3. It is allowed to be between 58 and 690 V at 50 - 60 Hz. It can be taken from one phase and the neutral conductor (standard connection) or between two phases. All phases have to be fused with max. 4A.

3.5 Measuring current

A suitable current transformer has to be connected to the terminals 6 and 7 of the measuring current input. It has to be mounted in one of the outer conductors before all loads and the capacitor bank. The connection of the current transformer terminals S1 (k) and S2 (l) to the terminals of the regulator without any special relation. If several current transformers are connected to a summation transformer, it has to be considered, that these have all the same current transformer ratio or that a special summation transformer has to be used. If a current transformer with a different transformer ratio is mounted after a complete putting into operation, or if any change has been made to the connection, then a reset of the regulator and a new putting into operation is required.

3.6 Switching outputs

The operating voltage for the contactors (max. 250 V / 50 - 60 Hz) is connected to terminal 12 of the regulator. It has to be fused with max. 4A. The connection of the contactor coils is made to terminals 13 - 16 for regulators with 4 switching outputs and to terminals 13 - 20 in the case of 8 switching outputs (see rating plate).

The CONDENSOMATIC 2000 is equipped with zero voltage tripping, that switches off all outputs, if the operating voltage breaks down for more than 15 ms. This avoids damage to contactors and capacitors. This protection is only efficient, if the operating voltage for the contactors is connected to the same phase as the operating voltage of the regulator.

The smallest capacitor step has to be connected to output 1 (see also: hints for switchboard builders).

3.7 Alarm output (CR 2000, optional for CR 2000B)

The potential free alarm output contact can be loaded up to 250 V / 2 A. The contact is closed in case of alarm or missing operating voltage and it is opened in normal operation.

3.8 Tariff switching input (CR 2000, optional for CR 2000B)

The potential free tariff switching input is controlled with max. 250 V and has to be protected with a fuse of max. 2 A.

If there is no input signal, then tariff 1 is active, otherwise tariff 2 is active.

3.9 RS485 interface (only CR 2000 with option S)

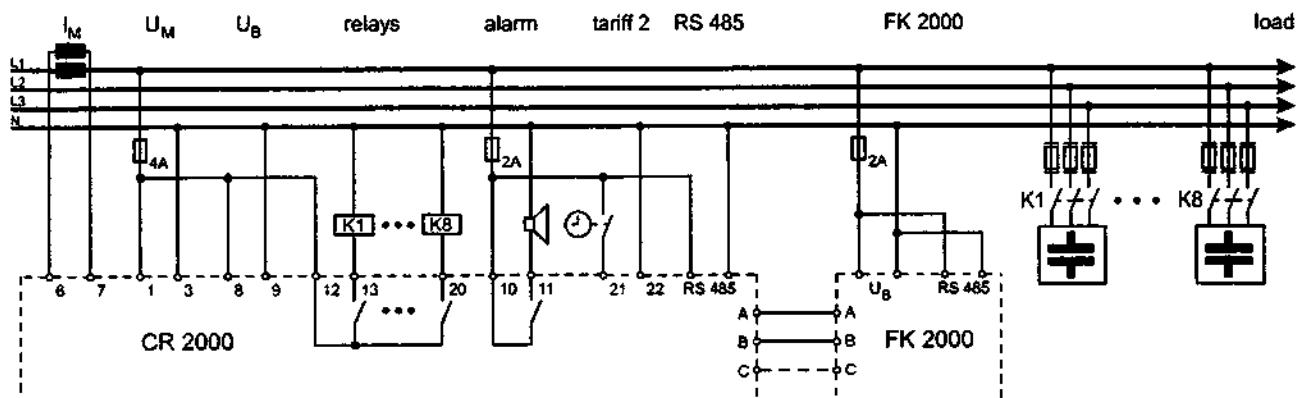
The optional interface operates according to the RS485 standard and offers a half-duplex connection at a RS485 line with a maximum of 32 instruments at one line.

The interface has to be connected to the operating voltage at its connector block.

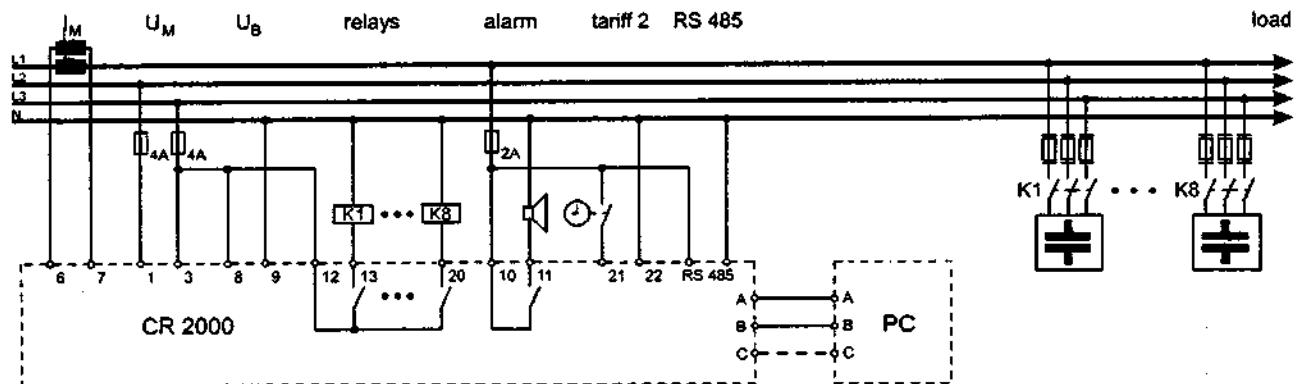
The line has to be carried out with a screened wire, the screen has to be earthed on one end. Both ends have to be terminated (approx. 100 - 150 ohms). The maximum line length is 1200 meters under ideal conditions.

4. Wiring diagrams

4.1 Standard connection (measuring voltage phase - neutral conductor)



4.2 Alternative connection (measuring voltage phase - phase)



5. Hints for switchboard builders

5.1 Power graduation

The intelligent control and the possibility of any power graduation meets all requirements for an effective reactive power compensation with minimized wear, even with 4 or 8 switching outputs. Also equipments with small capacitor steps are possible. As an example, the power graduation 1:2:4:8:16:16:16:16 allows 15 respectively 79 steps without problems. Practical experience shows that power factor correction equipments should be controlled in 6 to 20 steps.

The CONDENSOMATIC 2000 realizes an evenly distribution of wear to all capacitor steps. The greatest effect is obtained with power graduations, that include different groups of at least two equal capacitor steps.

Examples:

12.5 : 12.5 : 25 : 25	= 75 kvar in 6 steps
12.5 : 12.5 : 25 : 25 : 25	= 100 kvar in 8 steps
25 : 25 : 50 : 50 : 50 : 50	= 250 kvar in 10 steps
25 : 25 : 50 : 50 : 75 : 75	= 300 kvar in 12 steps
25 : 25 : 50 : 50 : 75 : 75 : 100 : 100	= 500 kvar in 20 steps

5.2 Smallest step

The smallest step power should be connected to the first output of the CONDENSOMATIC 2000, because this power determines the sensitivity of control. Beyond this all steps must fulfill the following condition:

The step power in kvar, divided by the current transformer ratio and the voltage transformer ratio, must be equal or greater than 0.05.

Example:

$$25 \text{ kvar} / (2500/5 \times 1) = 25 \text{ kvar} / 500 = 0.05 \quad \text{step power is great enough}$$



Outputs with too small capacitor powers are determined as not used and therefore excluded from further control.

6. Display and LEDs

Mean part of the display is the four digit display on the regulators front. It shows measured values and displays alarm messages. It also shows the switched on outputs.

CR 2000:

The menu list on the left with its LEDs shows, which value with which unit of measure is currently displayed. The LEDs „maximum“ and „setup“ flash, if the maximum or the setup menu is active instead of the main menu.

At displaying and programming of $\cos\phi$ -values, the LEDs „tarif 1“ oder „tarif 2“ show, to which tariff the currently display value belongs.

The LED „man“ lights only during the manual operating mode.

In the automatic mode „C+“ and „C-“ show the switching tendency. Additionally „C+“ flashes, if the switching of an output is delayed because of internal dead times after power on and in the manual mode.

The LED „gener.“ signals whether active power is consumed from or delivered to the supply system, independent of the operating mode.

CR 2000B:

On the left side of the front the menu items „F01“ to „F13“ are listed together with the corresponding units.. The display content is frequently altered between the menu item and the corresponding value. When showing $\cos\phi$ values for tariff 2 the last decimal point „tarif2“ is switched on.

The first two vertical bars in the display („C+“ and „C-“) show the tendency of switching during automatic mode while the actual $\cos\phi$ is displayed.

Display and LEDs are shown as follows:

<input type="radio"/>	set cos phi
<input checked="" type="radio"/>	cos phi
<input type="radio"/>	alarm cos phi

the LED „set cos phi“ is dark,
„cos phi“ lights continuously,
„alarm cos phi“ flashes

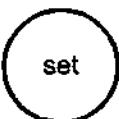
7. Keyboard functions



The key man toggles between automatic and manual operating mode. If it is held for more than 3 seconds when entering manual mode, all outputs are switched off.



The arrow keys down and up used for choosing menu items and for altering programmed values.



With the set key settings are altered and saved, maximum and setup menu are activated and deactivated. In the maximum mode it erases stored maximum values. Steps are switched on and off with this key in the manual mode.

Pressing more than one key at a time has no effect.
Holding all four keys for more than 5 seconds carries out a reset with putting to operation.

8. Putting into operation

8.1 Putting into operation under standard conditions

The CONDENSOMATIC 2000 requires only one key press for putting into operation under standard conditions. In all cases the following conditions have to be fulfilled before putting into operation:

- The reactive power compensation equipments must be ready for operation.
- The measuring current must be equal or greater than 20 mA, all bridges must be opened.

Your equipment meets the standard conditions, if:

- The measuring voltage is taken from one phase and the neutral conductor.
- Inductive load is present ($\cos \varphi$ between 0.40 and 0.99 inductive).
- active power is consumed from the supply system (no generator operating).

If one of these points is not fulfilled, go on with chapter „Putting into operation under special conditions“.

Switch on the operating voltage of the CONDENSOMATIC 2000.



The regulator starts displaying „Std“. Press the set key.



The display shows „CALC“ and the regulator determines the connection of measuring voltage and current. After successful completion the determination of the capacitor powers is carried out by switching on and off all outputs for few times, always obeying a blocking time of 30 seconds. This can take up to 12 minutes.



During the determination of capacitor powers the actually tested step is displayed by lighting the corresponding display segment. After ending this calibration the regulator starts automatic control and displays the actual $\cos \varphi$.

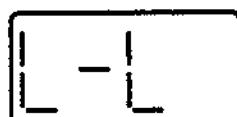
After this calibration the reactive power compensation equipment is in the automatic operating mode. For displaying the current and the powers as primary values, the current transformer ratio is needed and therefor it should be programmed next. Only in installations with the measuring done on the medium voltage level, the voltage transformer ratio is also required.

8.2 Putting into operation under special conditions



If the connection diverges from the standard connection or if there is a special situation in the supply system the putting into operation is carried out as follows. After switching on the operating voltage the regulator displays „Std“. Do not press set, but change the display content to „HAnd“ using the arrow keys.

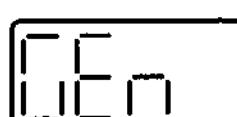
Press set for confirmation.



Now choose and confirm the kind of connection, phase-neutral conductor („L-n“) or phase-phase („L-L“)..



The operating conditions in the supply system, that means consumtion or delivery of energy, are asked next. For consumption choose and confirm „nor“.



If you have a generator running and delivering energy, than choose „GEN“.

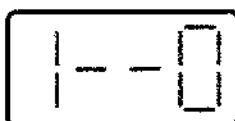


The last point is the programming of the actual supply system situation. Choose („ind“), if the system is inductive or („CAP“) for capacitive. In both cases a $\cos \varphi$ between 0.4 and 0.99is allowed.

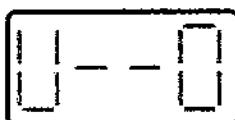
After confirmation of the last point the calibration is done, displaying „CALC“, similar to the standard connection.

8.3 Alarm messages during putting into operation

During putting into operation the measured values are checked. If they exceed their limit or if parts of the calibration can not be completed successfully, than one of the following alarms is displayed.



The measuring current is lower than 20 mA. Check the connection, the line and all present bridges. Make sure that the current transformer is not mounted in the feeding line of the compensation equipment. If necessary, switch on suitable load. If the fault condition is removed, the regulator continues with the calibration automatically.



The measuring voltage is lower than 50 V. Check the connection and all fuses. Calibration is continued when the voltage returns.



The automatic detection of the connection failed. The following causes are possible:

- The situation in the supply system does not meet the setting chosen during putting into operation. Start again with correct settings by resetting the regulator or interrupting the operating voltage.
- The actual $\cos \phi$ is not within 0.4 and 0.99, switch on or off suitable loads.
- The supply system is not calm enough, especially when changes between inductive and capacitive appear. Switch off rapid switching loads or start again later, when the situation is better.



The CONDENSOMATIC 2000 was not able to detect the capacitor power of the first output respectively the capacitor power is too small.

- Check all fuses and the equipment being ready for operation.
- Make sure, that the current transformer has not been mounted behind the reactive power compensation equipment.
- If the step power is too small (see also: hints for switch board builders), then a current transformer with smaller ratio has to be mounted or the step power has to be increased (ask your supplier of the reactive power compensation equipment!).

8.4 Reset

After repairing capacitor steps with preceding fault message, after extension of the capacitor bank, after changes of the connection and after changes of the current transformer ratio a reset with new calibration has to be carried out.

For this all four keys must be held for at least five seconds.
The CONDENSOMATIC 2000 starts as described in chapter 8.1.

9. Displayed values and settings

9.1 Main menu

The main menu includes the displaying of the network data and the harmonics, the step display, the settings of target- and alarm- $\cos\phi$, the programming of the harmonics limit and the menu items for choosing maximum- or setup menu.

The arrow keys allow choosing the menu item.

CR 2000:

The LED column on the left shows the active menu item with unit of measure. The LEDs for target- and alarm- $\cos\phi$ are used twice. The LEDs „tarif 1“ and „tarif 2“ signal to which tariff the actually displayed value belongs.

CR 2000B:

The list on the left shows all available menu items. The number of the menu item (e.g. „F02“ for the actual $\cos\phi$) alters with the corresponding value. If the last decimal point „tarif2“ lights, the actual displayed value belongs to tariff 2, otherwise to tariff 1.

9.1.1 Settings

For alteration of a setting the corresponding menu item is chosen and the programming mode is activated with the set key. The actual value flashes and can be changed with the arrow keys. Values with wide range, e.g. the current transformer ratio, are programmed character after character. The changed value is stored with set and the programming mode is left.

9.1.2 Target- $\cos\phi$

CR 2000:

- set cos phi
- cos phi
- alarm cos phi

In the automatic mode the CONDENSOMATIC 2000 tries to reach this $\cos\phi$ by switching on and off specific outputs. The target- $\cos\phi$ is programmed separately for tariff 1 and tariff 2 under the menu item „set cos phi“. The limits are 0.80 inductive and 0.80 capacitive. If the target- $\cos\phi$ is programmed lower than the corresponding alarm- $\cos\phi$, this one is corrected automatically.

This value should be set to 1, if not otherwise noted in the energy supplier's regulations. Alarm is signalled, if the alarm- $\cos\phi$ cannot be reached. The target- $\cos\phi$ has no effect on this.

CR 2000B:



9.1.3 Cos ϕ

CR 2000:

- set cos phi
- cos phi
- alarm cos phi

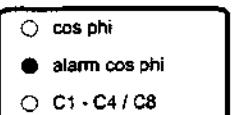
This menu item shows the actual $\cos\phi$. Simultaneously the LEDs „tarif 1“ and „tarif 2“ specify the actual tariff. This is controlled by the tariff switching input. The type CR 2000B indicates only tariff 2 with the last decimal point.

CR 2000B:



9.1.3 Cos ϕ

CR 2000:

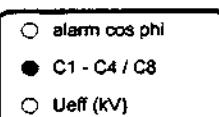


If this value could not be obtained, although all available outputs have been switched on or off during the programmed alarm time, this is indicated in this display and alarm output is closed (optional for CR 2000B).

CR 2000B:



9.1.5 Step display



This shows all switched on and defective capacitor steps. Every output has a corresponding display segment, on the upper border for the outputs 1 - 4 and on the lower border for the outputs 5 - 8 (see printed characters on the front). The segments flash for outputs with missing power or total fault.

The example shows the outputs 1, 2 and 6 being switched on and the output 4 being defective.

CR 2000B:



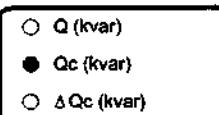
9.1.6 Network data

Under the menu items „U_{eff}“ to „ ΔQ_c “ the CONDENSOMATIC 2000 shows the measured and calculated network data. These are secondary values, if current transformer ratio and voltage transformer ratio are set to 1. If the current transformer ratio, and in installations with measurement on the medium voltage level also the voltage transformer ratio, are set correctly, then these are considered and the primary values are displayed. All powers are calculated for a three-phase system.

The following menu items are explained as examples.

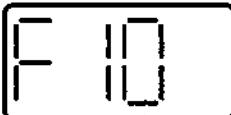
9.1.7 Switched on capacitor power

CR 2000:



Under the menu item „Q_c“ the currently switched on capacitor power is displayed, considering the actual mains voltage. The maximum value is stored and can be displayed in the maximum menu (not CR 2000B).

CR 2000B:



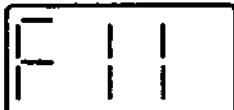
9.1.8 Missing capacitor power

CR 2000:

- Qc (kvar)
- ΔQc (kvar)
- 3. harm. (%)

This item shows the capacitor power, that is missing for reaching the programmed target- $\cos \phi$. In the case of all outputs being switched on and still capacitor power missing, the maximum is stored. This maximum is a help for the determination of the required power for extensions.

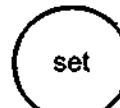
CR 2000B:



9.1.9 Current transformer ratio

CR 2000:

- U_{eff} (kV)
- I_{eff} (A)
- S (kVA)

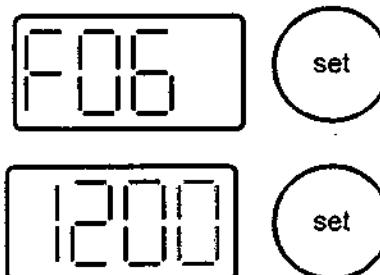


The programming of the current transformer ratio is not necessary for the operation of the CONDENSOMATIC. If it is set correctly, then all values are displayed as primary values.

This setting can be changed by choosing the menu item „I_{eff}“ and pressing set to activate the programming mode.

The ratio of primary to secondary value, that is given on your current transformer, has to be set, e.g. 500/5 = 100 or 1200/1 = 1200.

CR 2000B:



The value is set character after character, each character has to be confirmed with set. The confirmation of the last character stores the value.

9.1.10 Voltage transformer ratio

CR 2000:

- C1 - C4 / C8
- U_{eff} (kV)
- I_{eff} (A)



This value must only be set in installations with measurement on the medium voltage level. The programming is similar to the programming of the current transformer ratio.

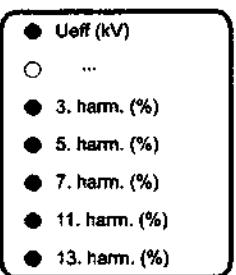
CR 2000B:



9.1.11 Displaying of harmonics, limit for harmonics

The CONDENSOMATIC (not CR 2000B) shows, separated for voltage and current, the harmonic levels for the 3., 5., 7., 11. and 13. harmonic as percentage of the fundamental wave.

The combination of the LEDs „U_{eff}“ bzw. „I_{eff}“ together with the LED for the harmonic shows the chosen harmonic value. If the total harmonic level of the voltage is chosen, then all LEDs for the harmonics light. In all types of regulators additionally the total harmonic distortion of the voltage is available (see examples of display contents).

CR 2000:

For the indication of the harmonic distortion of the voltage all LEDs for harmonics and voltage ligh (CR 2000B: display of „F12“).

Using **set** one activates the programming mode for the limit for the harmonic load. If the total harmonic load exceeds this limit, which is programmable between 3% and 10%, for more than 15 minutes, then all outputs are switched off.

The following settings are recommended, depending on the kind of reactive power compensation equipment:

non-reactor protected capacitor banks:	3%
--	----

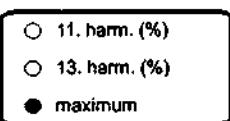
CR 2000B:

5.67% and 7% reactor protection:	6%
----------------------------------	----



14% reactor protection:	8%
-------------------------	----

If your supplier of the reactive power compensation equipment makes other recommendations, these have to be considered.

9.2 Maximum menu (only CR 2000)**CR 2000:**

From the main menu one gets to the maximum menu as follows:

Choose the menu item „maximum“, using the arrow keys. The LED „maximum“ lights and the display shows „OFF“. By pressing the **set** key, the maximum menu is activated, the display alters to „On“ and the LED „maximum“ flashes. The next preesing of **set** deactivates the maximum menu and the display changes to „OFF“.

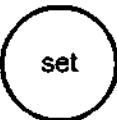
When the maximum menu is active, the menu items for powers and harmonics are available similar to the main menu. The menu items for cos φ - settings and the step display are not available.

The flashing LED „maximum“ indicates, that the actually displayed value is a stored maximum value.

The return to the main menu is done via the menu item „maximum“, choosing „OFF“.

CR 2000B:

For type CR 2000B only the maximum values of voltage and harmonic distortion are available in the setup menu (see setup menu).

9.3 Reset of maximum values

Any stored maximum can be deleted using the **set** key. The value is set to zero and stored again after the next measurement. The maximum values of voltage, current and the powers are deleted automatically, if the transformer ratio for voltage or current is changed. A reset of the regulator includes the deletion of all maximum values.

9.4 Setup menu

In the setup menu several settings allow the adaption of the control characteristic of the CONDENSOMATIC to special requirements. Additionally the number of switchings and the operating hours for every output can be displayed.

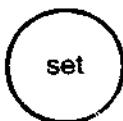
CR 2000:

- 13. harm. (%)
- maximum
- setup

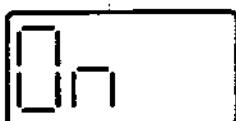


Choose the menu item „setup“ in the main menu, using the arrow keys. The LED „setup“ lights (CR 2000B: display „F12“) and the display shows „OFF“. Press the set key to activate the setup menu, the display changes to „On“ and the LED „setup“ starts to flash. Pressing set again returns to the main menu.

CR 2000B:



- 13. harm. (%)
- maximum
- setup



Inside the setup menu the item list on the left is not available. If another menu item is chosen with the arrow keys, than first the number of the new menu item is displayed for approximately 3 seconds, e.g. P03. After this the corresponding value is displayed continuously. For menu items with programming function, the programming mode is activated with the set key. After changing the value it is stored with set. The return to the main menu is done via the menu item „setup“ (CR 2000: LED „setup“ lights continuously instead of flashing) and the setting „OFF“.

9.4.1 Number of switchings



For the displaying of the number of switchings the menu item „A01“ bis „A08“ , corresponding to the outputs 1 - 8) is chosen (e.g. output 4). After 3 seconds the number of switchings for this output is displayed (display x 100). Pressing set resets this value to zero (e.g. after replacing the contactors).

9.4.2 Operating hours



Using the arrow keys one of the menu items „E01“ bis „E08“ is chosen in the setup menu. After 3 seconds the total operating hours of this output are displayed (display x 100). The value can be reset to zero with the set key (e.g. after replacing the capacitors).

9.4.3 Mains frequency



The actual mains frequency is displayed under the menu item „P01“.

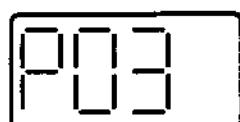
9.4.4 Switching time



The menu item „P02“ shows the programmed switching time. A reactive load , which is approximately twice the capacitor power connected to the first output, results in a switching activity after this time. For smaller reactive loads this time is delayed up to ten times to avoid unnecessary switchings. By pressing set the programming mode is activated and the switching time can be programmed from 3 - 30 seconds.

The factory setting 15 seconds is optimal for the most applications, great reactive loads are compensated quick enough, small reactive loads do not result in unnecessary switchings.

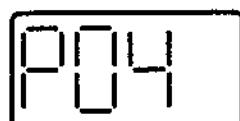
9.4.5 Alarm time



If the alarm- $\cos \varphi$ cannot be reached for longer than the programmed alarm time, then an alarm is displayed and the external alarm output contact is closed. After pressing set this setting can be changed from 30 up to 300 minutes. The factory setting is 60 minutes.

This alarm time does not delay any other alarm (e.g. harmonics alarm).

9.4.6 Alarm confirmation



This setting affects the behaviour of alarm messages in the display. If it is set to „OFF“, then the alarm messages in the display disappear with their causes (e.g. return of the measuring voltage). The setting „On“ has the effect, that alarm messages do not disappear automatically. They have to be confirmed with the set key.

9.4.7 Fixed compensation power



Caution! This setting must not be changed before the current and voltage transformer ratios are set correctly. Otherwise the regulator switches on too much capacitor power.



In most installations the measuring for the compensation is done behind the power transformer, that means, that the transformers reactive power is not measured and therefore not compensated. In lots of cases the energy supplier measures before the power transformer and the reactive power has to be paid. In the past this reactive power has been compensated basically with a fixed capacitor.

By programming a fixed compensation power as a basic load, the reactive power of the transformer can be compensated by the automatic reactive power compensation equipment.

According to the actual load the CONDENSOMATIC calculates the required capacitor power and adds the fixed compensation power. The result is switched on with the switching outputs.

This has the effect, that the actual $\cos \varphi$ is always better than the target - $\cos \varphi$, at the measuring point of the compensation equipment it can get capacitive.

9.4.8 Limit for switchings



The CONDENSOMATIC counts the number of switchings for every output. With the programming of a surveilled limit, contactors can be replaced at the right time. If the number of switchings of any output exceeds this limit (factory setting 100.000), this is displayed with „AL.A1“ - „AL.A8“.

The setting „0“ disables this function.

The message in the display must be confirmed with set. A new message for an output, that has exceeded the limit once before, can only be generated, if the number of switchings for this output has been reset to zero before.

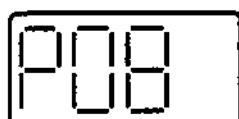
9.4.9 Over- and undervoltage



The programmation of the rated measuring voltage enables over- and undervoltage detection.

If the actual measuring voltage diverges from the set value more than 15%, then all outputs are switched off to avoid damage and overload of contactors and capacitors. The range is from 58 to 700 V, the setting „OFF“ (<58 Volt) disables this function (factory setting).

9.4.10 Device number (only CR 2000 with option S)



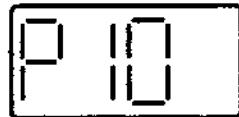
The device number identifies the CONDENSOMATIC 2000 on a RS485-line with up to 32 instruments. The range is from 1 to 32.

9.4.11 Baudrate (only CR 2000 with option S)



The baudrate is the operating speed of the RS485-line. The baudrate must be set equal for master and slaves on the bus. The CONDENSOMATIC can operate at a baudrate of 300, 600, 1200, 2400, 4800 or 9600 baud.

9.4.12 Parity (only CR 2000 with option S)



The parity setting has to be equal for all connected instruments on the line. The settings 0, 1, 2 mean:
0=no parity, 1=odd, 2=even.

9.4.13 Maximum voltage (only CR 2000B)



The CONDENSOMATIC 2000B shows the maximum measured voltage under this menu item. Using set resets the maximum value.

9.4.14 Maximum harmonic distortion (only CR 2000B)



Here the maximum distortion of the voltage is displayed. Pressing set resets this maximum value.

10. Alarms in automatic mode

Alarm conditions are indicated with a flashing display message and sometimes additionally through flashing LEDs in the menu list. If more than one alarm is pending, these are repeated one after the other till their causes disappear and, depending on the settings, they have been confirmed with set.

All alarms, excluding the exceeding of the limit for switchings, include the closing of the external alarm contact (optional for CR 2000B) as long as the alarm is pending.

The alarms for missing measuring signals, for defective outputs and for harmonic overload result in a temporary or continuous switching off of outputs.

10.1 Cos φ-alarm

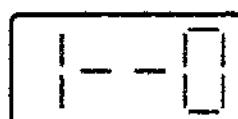


This alarm appears if the active alarm-cos φ cannot be reached for longer than the programmed alarm time by switching on and off all suitable outputs.



Check the setting for alarm-cos φ and correct it, if required. If the setting is correct, then the installed capacitor power has to be adapted by repairment or extension (see also the maximum of missing capacitor power)

10.2 Missing measuring current alarm

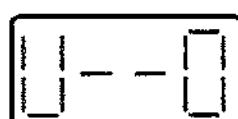


If the measuring current is lower than 20 mA, all capacitor steps are switched off.



This alarm must be ignored, if no load is present. Otherwise the measuring current circuit must be checked, present current transformer bridges have to be closed. The automatic control is continued, if the measuring signals exceed 20 mA.

10.3 Undervoltage, missing measuring voltage alarm



This alarm can have one of the two following causes. If the rated measuring voltage is programmed, alarm is given and all capacitor steps are switched off, if the measuring voltage is lower than 85% of the rated value. Incase the rated value is not programmed, alarm is given for measuring voltages lower than 50 V.



To avoid unnecessary alarms, the rated measuring voltage has to be set correctly. A lower value can be programmed, if the supplier of the contactors guarantees correct function of the contactors even at lower voltages.

10.4 Overvoltage alarm



Alarm for overvoltage is only possible, if the rated measuring voltage has been programmed. If the measuring voltage exceeds the programmed value for more than 15%, all outputs are switched off to avoid overload, and alarm is displayed.



If this alarm appears frequently, because of the voltage being permanently high, one should check, if the capacitors are suitable for higher voltages. If they are, the programmed value for the rated measuring voltage can be increased.

10.5 Resonance alarm



If the harmonic load reaches very high values due to a resonance, all outputs are switched off immediately. After the end of the resonance automatic control is continued.



The situation in the supply system has to be clarified. Perhaps non-reactor protected reactive power compensation equipments have to be substituted with reactor protected equipments.

10.6 Harmonic overload



If the total harmonic load, calculated from the displayed harmonic values, exceeds the programmed limit for more than 15 minutes, all capacitors are switched off and alarm is displayed. The delay time is shortened for higher harmonic overloads. Automatic control is continued, if the harmonic load has reached values lower than the limit.

Check the programmed limit against the table in chapter „Harmonics limit”.



10.7 Defective outputs



If the capacitor power related to an output is detected to be lower than 80% of the power determined during calibration, the respective output is switched off and displayed with its number (e.g.: output 2). It is not used any more.

The output can be switched on manually to check its power. After repairing the capacitors a new calibration must be started by resetting the regulator.



10.8 Operating hours limit



The output with the displayed number (e.g.: output 7) has exceeded the limit programmed in the setup menu.

This message has to be confirmed with **set**. Resetting the number of operating hours for this output makes the feature available again. Automatic control is not affected and the external alarm contact is not closed.

11. Manual mode

The manual operating mode is used for stopping the automatic control, for determination of fault causes by switching on and off outputs manually and for switching off of all outputs before disconnecting the operating voltage.



At any time and from any menu pressing the **man** key starts the manual mode. This is indicated with the LED „man“.

When changed, the operating mode is stored, so that a regulator switched off in manual mode will start again in manual mode.

Short pressing of **man** starts the manual mode with all switched on outputs remaining switched on, only the automatic control and the alarm functions are disabled. Holding the key for approximately 3 seconds starts the immediate switching off of all outputs. Automatic control is disabled. The storage of the operating mode guarantees, that all outputs are kept switched off permanently without need for external switches.



In the manual mode the step display is active, extended by two flashing segments, which form a cursor. This cursor marks the actually chosen output, which can be switched on and off with the **set** key. Switching off blocks an output for 30 seconds. A new switching on is delayed till the end of this blocking time, indicated by a flashing LED „C+“ (not CR 2000B).



In the manual mode alarms are not active. Avoid capacitive overload.

When changing from the manual mode to automatic mode, a blocking time of 30 seconds is active for the automatic control. This way, the power of previously switched on outputs can be checked.

12. RS485 interface (only CR 2000 with option S)

12.1 Technical data

interface standard:	RS485
max. no. of instruments:	32
baudrates:	300, 600, 1200, 2400, 4800, 9600 baud
parity:	no parity, odd, even
data bits:	8
stop bits:	1
max. line length:	1200 m with screened and terminated wire
protocol:	special protocol, see below
operating voltage:	230V / 50-60Hz
power consumption:	max. 2VA

12.2 Settings for RS485 interface

The numbers of data- and stopbits are fixed to 8 data bits and 1 stop bit.

The behaviour of the interface is programmed through the parameters „device no.“, „baudrate“ and „parity“.

12.3 Request for settings and data

The requestable parameters and measured data, further on called „variables“, have numbers from 0 to 23 and from 32 to 83. All the variables can be requested from the regulator by these numbers.

To read a variable, a sequence of characters is send to the regulator, starting with <STX> (= 02 dec), followed by the device no. of the regulator (1 - 32), the read command „R“ (= 82 dec), the no. of the variable, two dummy characters, a ending character <ETX> (=03 dec) and a checksum byte (=exclusive or of all preceeding characters).

syntax: <STX>, device no., R, no. of variable, dummy, dummy, <ETX>, checksum

example: 02 01 82 01 00 00 03 83

The example explaines the reading of the target-cos φ for tariff 2 (variable no. 01) from the regulator with the device no. 1.

The regulator answers the request, if a reading command is determined to be complete and correct. The answering sequence consists of the start character <STX>, the device no. of the regulator, the answer command „A“ (= 65 dec),the variable no., two bytes data, the ending character <ETX> and the checksum.

12.4 Programming of parameters



For the programming of parameters one has to consider the limits for each parameter, which are listed in the enclosed table. The regulator does not check the programmed data to be within the allowed limits. Wrong parameter settings will affect correct function of the regulator or its reliability.

The programming sequence consists of the start character <STX>, the device no. of the regulator, the write command „W“ (= 87 dec), the variable no., two bytes data to be programmed, the ending character<ETX> and the checksum.

For the reset of maximum values of powers and harmonics the content of the data bytes is not relevant. Any write command to the variables results in a reset of these values.

12.5 List of variable numbers (with limits)

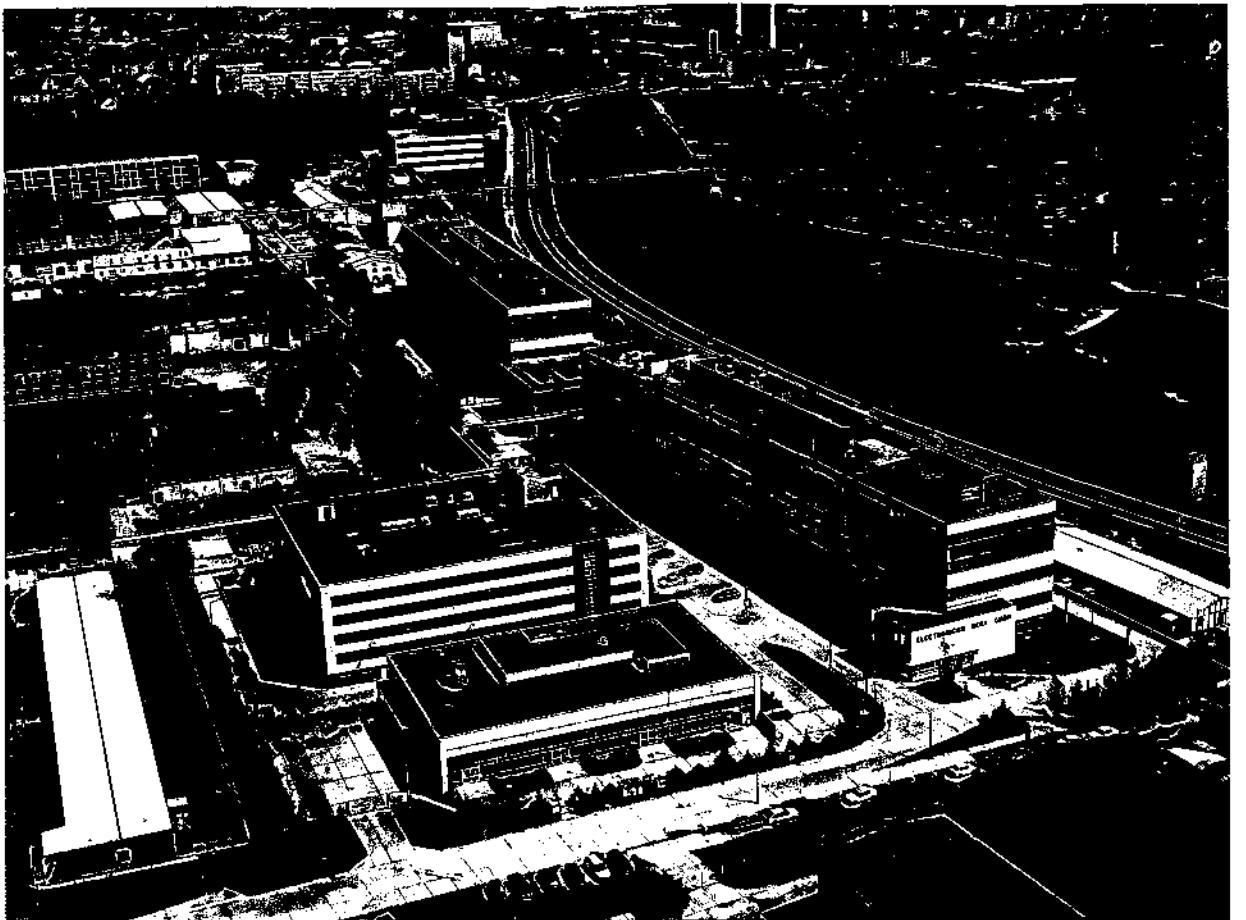
- 00 target-cos φ for tariff 1 (0 - 199, 0 - 100 = 0.00 - 1.00 inductive, 101 - 199 = 0.99 - 0.01 capacitive)
- 01 target-cos φ for tariff 2 (0 - 199)
- 02 actual cos φ (0 - 199)
- 03 alarm-cos φ for tariff 1 (0 - 199)
- 04 alarm-cos φ for tariff 2 (0 - 199)
- 05 voltage transformer ratio (1 - 9999)
- 06 current transformer ratio (1 - 9999)
- 07 limit for harmonic distortion of voltage in 0.1% (20 -90)
- 08 alarm delay in 10 minutes (3 - 30)
- 09 switching time in seconds (3 - 30)
- 10 confirmation of alarms On/Off (0=Off, >0=On)
- 11 rated measuring voltage for over- and undervoltage alarm in volts (0=Off, 58 - 700)
- 12 limit of switchings (0=Off, 1 - 9999)
- 13 fixed compensation power in kvar (0 - 9999)
- 14 parity (0=none, 1=odd, 2=even)
- 15 baudrate (0=300, 1=600, 2=1200, 4=2400, 5=4800, 6=9600)
- 16 device no. (1 - 32)
- 17 reserviert
- 18 operating mode (0=automatic, 127=manual)
- 19 energy flow direction (0=consumption, 127=delivery)
- 20 tariff (0=tariff1, 127=tariff2)
- 21 alarm no. (0=no alarm, 1=cos φ not reached, 2=harmonic alarm, 3=overvoltage, 4=undervoltage, 5=measuring current too low, 6=resonance)
- 22 switched on outputs (bit 0 = 0: output1 = off, bit 0 = 1: output 1 = on, bit 1 = 0: output 2 = off, ...)
- 23 defective outputs (bit 0 = 0: output 1 = o.k., bit 0 = 1:capacitor power on output 1 = not o.k., bit 2 = 0: output 2 = o.k., ...)
- 24-31 not used
- 32 Ueff in kV (0 - 65535, consider voltage transformer ratio!)
- 33 Ieff in A (0 - 65535, consider current transformer ratio!)
- 34 S in kVA (0 - 65535)
- 35 P in kW (0 - 65535)
- 36 Q in kvar (0 - 65535)
- 37 switched on capacitor power in kvar (0 - 65535)
- 38 missing capacitor power to target-cos φ in kvar (0 - 65535)
- 39 harmonic distortion of U in 0.1% of fundamental (0 - 65535)
- 40 3. harmonic of U in 0.1% of fundamental (0 - 65535)
- 41 5. harmonic of U in 0.1% of fundamental (0 - 65535)
- 42 7. harmonic of U in 0.1% of fundamental (0 - 65535)
- 43 11. harmonic of U in 0.1% of fundamental (0 - 65535)
- 44 13. harmonic of U in 0.1% of fundamental (0 - 65535)

- 45 3. harmonic of I in 0.1% of fundamental (0 - 65535)
- 46 5. harmonic of I in 0.1% of fundamental (0 - 65535)
- 47 7. harmonic of I in 0.1% of fundamental (0 - 65535)
- 48 11. harmonic of I in 0.1% of fundamental (0 - 65535)
- 49 13. harmonic of I in 0.1% of fundamental (0 - 65535)
- 50 maximum of Ueff in kV (0 - 65535)
- 51 maximum of Ieff in A (0 - 65535)
- 52 maximum of S in kVA (0 - 65535)
- 53 maximum of P in kW (0 - 65535)
- 54 maximum of Q in kvar (0 - 65535)
- 55 maximum of switched on capacitor power in kvar (0 - 65535)
- 56 maximum of missing capacitor power in kvar (0 - 65535)
- 57 maximum of harmonic distortion of U in 0.1% of fundamental (0 - 65535)
- 58 maximum of 3. harmonic of U in 0.1% of fundamental (0 - 65535)
- 59 maximum of 5. harmonic of U in 0.1% of fundamental (0 - 65535)
- 60 maximum of 7. harmonic of U in 0.1% of fundamental (0 - 65535)
- 61 maximum of 11. harmonic of U in 0.1% of fundamental (0 - 65535)
- 62 maximum of 13. harmonic of U in 0.1% of fundamental (0 - 65535)
- 63 maximum of 3. harmonic of I in 0.1% of fundamental (0 - 65535)
- 64 maximum of 5. harmonic of I in 0.1% of fundamental (0 - 65535)
- 65 maximum of 7. harmonic of I in 0.1% of fundamental (0 - 65535)
- 66 maximum of 11. harmonic of I in 0.1% of fundamental (0 - 65535)
- 67 maximum of 13. harmonic of I in 0.1% of fundamental (0 - 65535)
- 68 no. of switchings of output no. 1 in 25 (0 - 65535)
- 69 no. of switchings of output no. 2 in 25 (0 - 65535)
- 70 no. of switchings of output no. 3 in 25 (0 - 65535)
- 71 no. of switchings of output no. 4 in 25 (0 - 65535)
- 72 no. of switchings of output no. 5 in 25 (0 - 65535)
- 73 no. of switchings of output no. 6 in 25 (0 - 65535)
- 74 no. of switchings of output no. 7 in 25 (0 - 65535)
- 75 no. of switchings of output no. 8 in 25 (0 - 65535)
- 76 operating hours of output no. 1 in 100 hours (0 - 65535)
- 77 operating hours of output no. 2 in 100 hours (0 - 65535)
- 78 operating hours of output no. 3 in 100 hours (0 - 65535)
- 79 operating hours of output no. 4 in 100 hours (0 - 65535)
- 80 operating hours of output no. 5 in 100 hours (0 - 65535)
- 81 operating hours of output no. 6 in 100 hours (0 - 65535)
- 82 operating hours of output no. 7 in 100 hours (0 - 65535)
- 83 operating hours of output no. 8 in 100 hours (0 - 65535)

13. Technical data

measuring system:	single phase, electronic
measuring voltage:	58 - 690 V
operating voltage:	230 V *
frequency:	50 - 60 Hz
measuring current:	1 A or 5 A
relay load:	max. 250 V / 4 A
ambient temperature:	-10 - +55°C
case:	safety insulation for mounting in switchboard panels or on DIN-rail
dimensions:	144 x 144 x 55 mm
protection class:	front IP42 (IP54 on request) rear side IP20
connection:	pluggable connection block

* other voltages on request



ELECTRONICON Kondensatoren GmbH has been associated with the manufacture of capacitors in Gera since 1938, when the SIEMENS organisation moved part of its production facility from Berlin to eastern Thuringia in the heart of Germany.

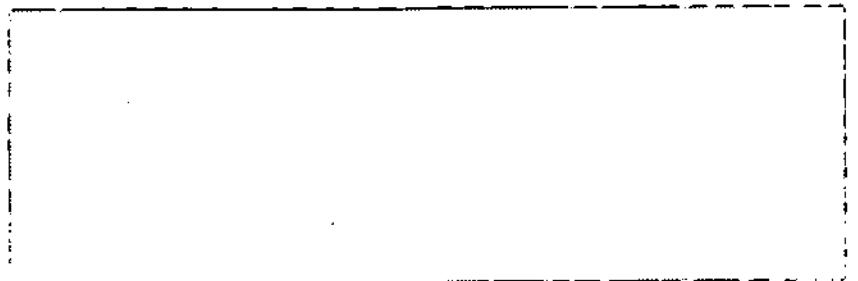
During the past 50 years the company has extended considerably. Continual development in its product ranges has resulted in ELECTRONICON becoming one of Europe's leading capacitor manufacturers supplying customers on all five continents.

The company employs about 180 qualified engineers and skilled workers in its manufacturing facility, producing capacitors for lighting, motor, and power electronics applications, further components, modules and capacitor banks for power factor correction, and electronic ballasts.

Recent investment in advanced and environmentally sound technologies guarantees the highest standards in manufacture and quality to standards which are approved worldwide. The ELECTRONICON system of quality assurance has been approved by the TUV organisation to ISO 9001.

Since 1985 the company has also been in a position to offer metallized dielectric material complying with highest technical standards.

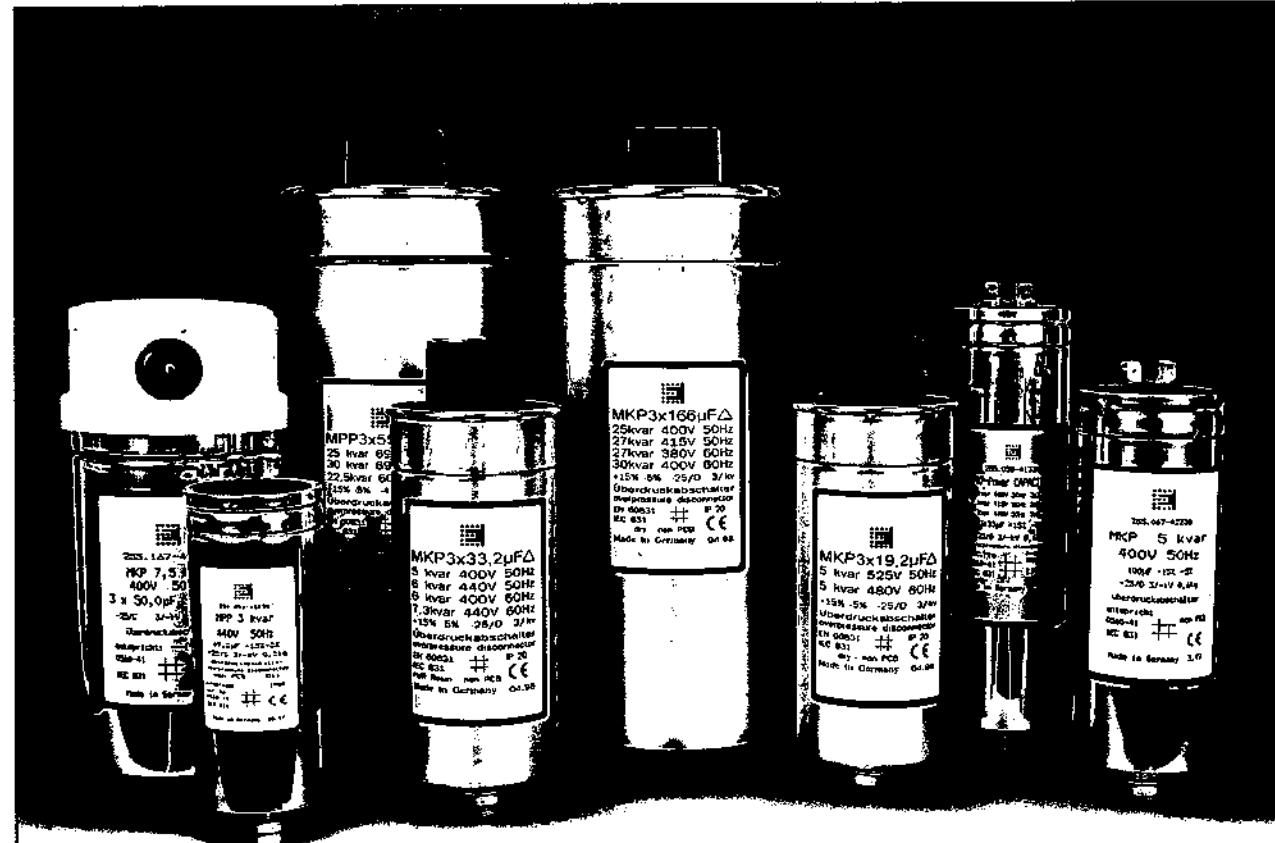
Your local distributor:



printed on environmentally clean paper



NRTL /C



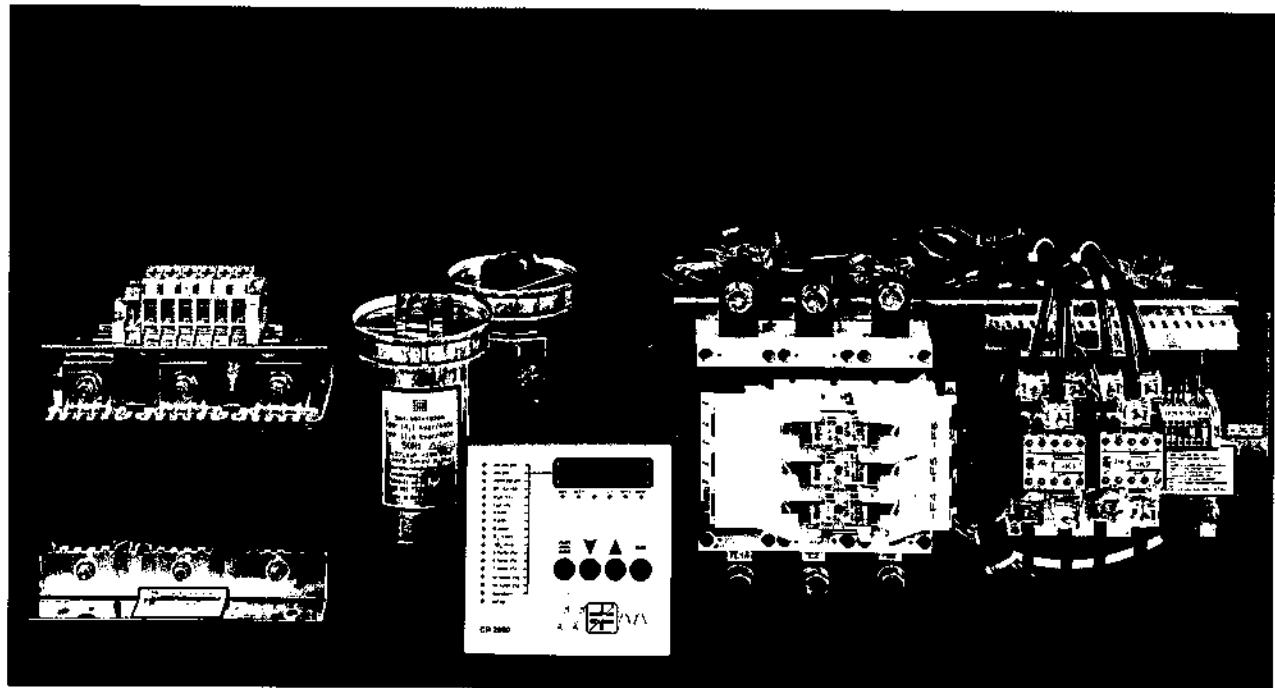
CAPACITORS FOR POWER FACTOR CORRECTION

КОНДЕНСАТОРЫ ДЛЯ УЛУЧШЕНИЯ КОЭФФИЦИЕНТА МОЩНОСТИ
CAPACITORES PARA LA CORRECTURA DEL FACTOR DE POTENCIA
CONDENSATEURS POUR RECTIFIER LE COS PHI



DIN EN ISO 9001
Certificate: 09 100 6036





Our product program

- Power capacitors
- Equipment and modules for power factor correction
- Reactors
- Power factor controllers
- Capacitors for power electronics
- Capacitors for discharge lamps, for parallel and series connection
- Electronic ballasts
- Motor capacitors
- Metallizing of paper and film

Notes:



CAPACITORS

IN MKP AND MPP TECHNOLOGY

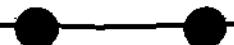


FOR POWER FACTOR CORRECTION

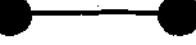
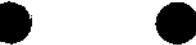
IN 50/60 Hz NETWORKS



ELECTRONICON Kondensatoren GmbH GERA



Notes:



Packing details

capacitor dimensions D1 x H	pcs./box	box dimensions
35 x 148	50	380 x 200 x 185
40 x 148	36	380 x 200 x 185
45 x 148	32	380 x 200 x 185
50 x 148	21	380 x 200 x 185
55 x 148	18	380 x 200 x 185
60 x 148	18	380 x 200 x 185
65 x 148	10	380 x 200 x 185
60 x 176	10	400 x 160 x 270
75 x 176	4	400 x 160 x 270
85 x 176	3	400 x 160 x 270
95 x 176	3	400 x 160 x 270
116 x 176	3	400 x 160 x 270
60 x 245	10	400 x 160 x 335
75 x 245	4	400 x 160 x 335
85 x 245	3	400 x 160 x 335
95 x 245	3	400 x 160 x 335
116 x 245	3	400 x 160 x 335
95 x 320	2	315 x 150 x 360
116 x 320	2	315 x 150 x 360
290 x 133 x 340 {battery}	1	315 x 150 x 400

This catalogue outlines the standard selection of 50/60 Hz power capacitors.

Available on request:

- cylindrical capacitors with differing ratings and voltages up to 1000 V;
- cylindrical capacitors for frequencies others than 50 or 60 Hz;
- assemblies for fixed compensation
 - with fuse disconnector
 - with audio-frequency filter
 - in free-standing or wall-mounting cabinets, with or without detuning reactors
- multi-tapped capacitors
- automatic power factor correction equipment
- modules for automatic P.F. correction equipment

Contents

The principles of power factor correction	5
Methods of power factor correction	5
Calculation of the capacitor size	6
Harmonic distortion and filtering	7
Mounting instructions	8
Selection of the rated voltage / rated power	9
Construction of the capacitors	11
Safety of the capacitors	12
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General technical data	14
MKP Power Capacitors	15
MKP 230 V 50 Hz	15
MKP 400 V 50 Hz	16/17
MKP 415 V 50 Hz	18
MKP 440 V 50 Hz	19
MKP 525 V 50 Hz / 480 V 60 Hz	20
MKP 230 V 60 Hz	21
MKP 400 V 60 Hz	22
MKP 440 V 60 Hz	23
MPP Power Capacitors	24
MPP 400 V 50 Hz	24
MPP 415 V 50 Hz	25
MPP 440 V 50 Hz	26
MPP 525 V 50 Hz / 480 V 60 Hz	27
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Protective caps

Plastic protective caps are available to protect the capacitor terminals against accidental contact or the influence of dust and water.

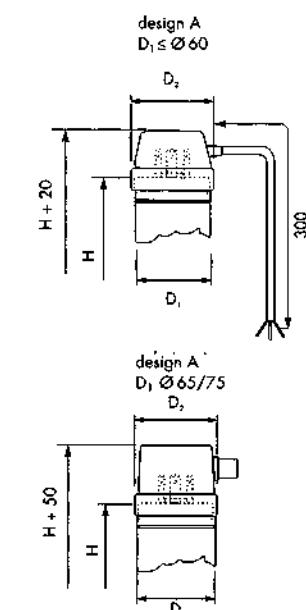
The following standard caps are available:

For design A

Protective caps for design A capacitors with diameters up to (and including) 60 mm are fixed to the capacitors when ordered. They are provided with a lead and integrated discharge resistors.
For design A capacitors with diameters of 65 mm and 75 mm, the protective caps are added to the packing unit as loose items when ordered.

D1	D3
35	38
40	43
45	48
50	53
55	58
60	63
65	69
75	79

Dimension drawings
capacitors with protective cap

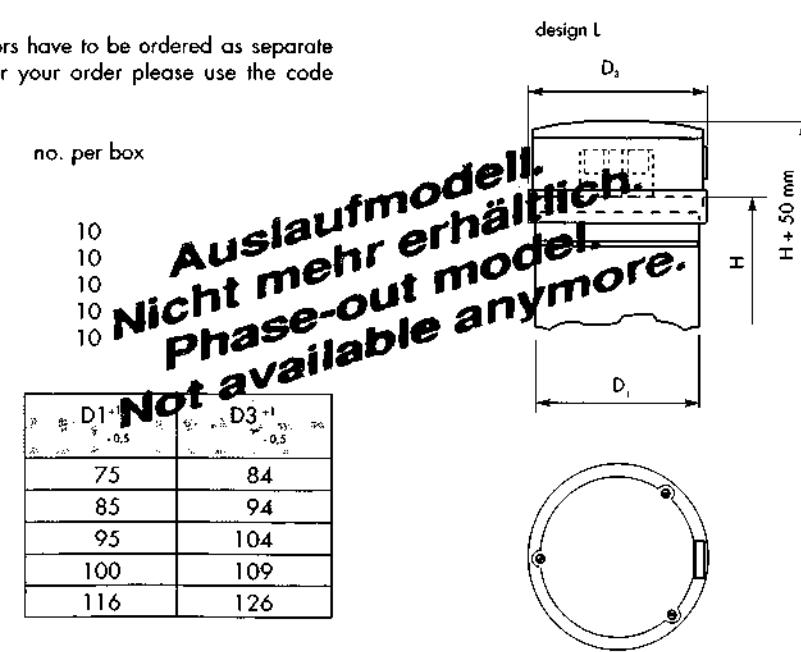


For design L

Protective caps for design L capacitors have to be ordered as separate items in separate packing units. For your order please use the code number shown below.

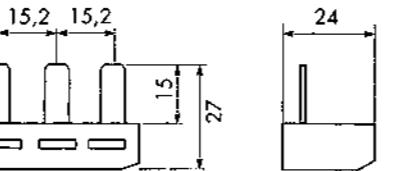
diameter D1	ordering code	no. per box
75 mm	275.147-10010	10
85 mm	275.157-10010	10
95 mm	275.167-10010	10
100 mm	275.177-10010	10
116 mm	275.187-10010	10

D1 + -0.5	D3 + -0.5
75	84
85	94
95	104
100	109
116	126



Accessories - data charts for discharge modules

module 1	3 x 82kΩ	275.100-10082
module 2	3 x 120kΩ	275.100-10120
module 3	3 x 180kΩ	275.100-10180
module 4	3 x 300kΩ	275.100-10300



Discharge module for design L

discharge within 40 s to < 50 V

operating voltage	three phase capacitors max.partial capacitance to be discharged				single phase capacitors max.total capacitance to be discharged			
	1	2	3	4	1	2	3	4
230 V	260 µF	178 µF	119 µF	71 µF	391 µF	267 µF	178 µF	107 µF
380 V	205 µF	140 µF	94 µF	56 µF	308 µF	211 µF	140 µF	84 µF
400 V	201 µF	137 µF	92 µF	55 µF	302 µF	206 µF	137 µF	82 µF
415 V	198 µF	135 µF	90 µF	54 µF	297 µF	203 µF	135 µF	81 µF
440 V	193 µF	132 µF	88 µF	53 µF	290 µF	198 µF	132 µF	79 µF
465 V	189 µF	129 µF	86 µF	52 µF	284 µF	194 µF	129 µF	78 µF
480 V	187 µF	128 µF	85 µF	51 µF	281 µF	192 µF	128 µF	77 µF
525 V	-	124 µF	82 µF	49 µF	-	185 µF	124 µF	74 µF
580 V	-	119 µF	79 µF	48 µF	-	179 µF	119 µF	71 µF
600 V	-	118 µF	78 µF	47 µF	-	177 µF	118 µF	71 µF
690 V	-	-	75 µF	45 µF	-	-	112 µF	67 µF
760 V	-	-	-	43 µF	-	-	-	65 µF

discharge within 60 s to < 50 V

operating voltage	three phase capacitors max.partial capacitance to be discharged				single phase capacitors max.total capacitance to be discharged			
	1	2	3	4	1	2	3	4
230 V	391 µF	267 µF	178 µF	107 µF	586 µF	401 µF	267 µF	160 µF
380 V	308 µF	211 µF	140 µF	84 µF	462 µF	316 µF	211 µF	126 µF
400 V	302 µF	206 µF	137 µF	82 µF	452 µF	309 µF	206 µF	124 µF
415 V	297 µF	203 µF	135 µF	81 µF	446 µF	305 µF	203 µF	122 µF
440 V	290 µF	198 µF	132 µF	79 µF	435 µF	297 µF	198 µF	119 µF
465 V	284 µF	194 µF	129 µF	78 µF	426 µF	291 µF	194 µF	116 µF
480 V	281 µF	192 µF	128 µF	77 µF	421 µF	288 µF	192 µF	115 µF
525 V	-	185 µF	124 µF	74 µF	-	278 µF	185 µF	111 µF
580 V	-	179 µF	119 µF	71 µF	-	268 µF	179 µF	107 µF
600 V	-	177 µF	118 µF	71 µF	-	265 µF	177 µF	106 µF
690 V	-	-	112 µF	67 µF	-	-	168 µF	101 µF
760 V	-	-	-	65 µF	-	-	-	98 µF

discharge within 3 min to < 75 V

operating voltage	three phase capacitors max.partial capacitance to be discharged				single phase capacitors max.total capacitance to be discharged			
	1	2	3	4	1	2	3	4
230 V	1496 µF	1022 µF	682 µF	409 µF	2244 µF	1534 µF	1022 µF	613 µF
380 V	1115 µF	762 µF	508 µF	305 µF	1672 µF	1143 µF	762 µF	457 µF
400 V	1086 µF	742 µF	495 µF	297 µF	1630 µF	1114 µF	742 µF	445 µF
415 V	1067 µF	729 µF	486 µF	292 µF	1600 µF	1094 µF	729 µF	437 µF
440 V	1037 µF	709 µF	473 µF	284 µF	1556 µF	1063 µF	709 µF	425 µF
465 V	1011 µF	691 µF	461 µF	276 µF	1517 µF	1036 µF	691 µF	415 µF
480 V	996 µF	681 µF	454 µF	272 µF	1495 µF	1021 µF	681 µF	409 µF
525 V	-	654 µF	436 µF	262 µF	-	981 µF	654 µF	393 µF
580 V	-	627 µF	418 µF	251 µF	-	941 µF	627 µF	376 µF
600 V	-	618 µF	412 µF	247 µF	-	927 µF	618 µF	371 µF
690 V	-	-	390 µF	234 µF	-	-	585 µF	351 µF
760 V	-	-	-	225 µF	-	-	-	338 µF

The Principles of Power Factor Correction

Under normal operating conditions certain electrical loads (e.g. induction motors, welding equipment, arc furnaces and fluorescent lighting) draw not only active power from the supply, but also inductive reactive power (kvar). This reactive power is necessary for the equipment to operate correctly but could be interpreted as an undesirable burden on the supply.

The power factor of a load is defined as the ratio of active power to apparent power, i.e. kW : kVA and is referred to as cosφ. The closer cosφ is to unity, the less reactive power is drawn from the supply.

- For systems with a low power factor the transmission of electric power in accordance with existing standards results in higher expenses both for the supply distribution companies and the consumer.
- Another reason for higher expenses are losses incurred via heat dissipation in the leads caused by the overall current of the system as well as via the windings of both transformers and generators.

If we assume for our above example that with cosφ = 1 the power dissipated would amount to about 10 kW, then a power factor of 0.6 would result in a 180% increase in the overall dissipation i.e. 28 kW.

- In general terms, as the power factor of a three phase system decreases, the current rises. The heat dissipation in the system rises proportionately by a factor equivalent to the square of the current rise.

This is the main reason behind why Electricity Supply Companies in modern economies demand reduction of the reactive load in their networks via improvement of the power factor. In most cases, special reactive current tariffs penalise consumers for poor power factor.

Conclusion:

- A reduction in the overall cost of electricity can be achieved by improving the power factor to a more economic level.
- The supply will be able to support additional load which may be of benefit for an expanding company.
- Reducing the load on distribution network components by power factor improvement will result in an extension of their useful life.

Methods of Power Factor Correction

Opposing capacitive reactive power resulting from the connection of a correctly sized capacitor can compensate for the inductive reactive power required by the electrical load. This ensures a reduction in the reactive power drawn from the supply and is called Power Factor Correction.

Most common methods of power factor correction are:

Single or fixed PFC, compensating for the reactive power of individual inductive loads right on the spot and reducing the load in the feeding leads (typical for single, permanently operated loads with constant and/or big power)

Group PFC - connecting one fixed capacitor to a group of simultaneously operated inductive loads (e.g. group of motors, discharge lamps)

Central PFC, typical for large electrical systems with fluctuating load where it is common to connect a number of capacitors to a main power distribution station or substation. The capacitors are controlled by a microprocessor based relay which continuously monitors the reactive power demand on the supply. The relay connects or disconnects the capacitors to compensate for the actual reactive power of the total load and to reduce the overall demand on the supply.

A typical power factor correction system would incorporate a number of capacitor sections determined by the characteristics and the reactive power requirements of the installation under consideration. Sections of 12.5 kvar, 25 kvar, and 50 kvar are usually employed. Larger stages (e.g. 100 kvar and above) are achieved by cascading a number of smaller sections. This has the beneficial effect of reducing fluctuations in the mains caused by the inrush currents to the capacitors and minimises supply disturbances. Where harmonic distortion is of concern, appropriate systems are supplied incorporating detuning reactors.

Calculation of the Capacitor Size

The reactive power which is necessary to achieve a desired power factor is calculated by the following formula:

$$Q_C = P \{ \tan\phi_1 - \tan\phi_2 \}$$

P active power of the load to be corrected
 Q_C reactive power of the required correcting capacitor
 cos ϕ_1 original power factor before correction
 cos ϕ_2 new power factor

The factor {tan ϕ_1 - tan ϕ_2 } can be determined by means of the chart below:

original power factor cos ϕ_1	tan ϕ_1	multiplication factor {tan ϕ_1 - tan ϕ_2 } for a target power factor cos ϕ_2									
		0.70	0.75	0.80	0.85	0.90	0.92	0.94	0.96	0.98	1.00
0.20	4.899	3.879	4.017	4.149	4.279	4.415	4.473	4.536	4.607	4.696	4.899
0.25	3.873	2.853	2.991	3.123	3.253	3.389	3.447	3.510	3.581	3.670	3.873
0.30	3.180	2.160	2.298	2.430	2.560	2.695	2.754	2.817	2.888	2.977	3.180
0.35	2.676	1.656	1.795	1.926	2.057	2.192	2.250	2.313	2.385	2.473	2.676
0.40	2.291	1.271	1.409	1.541	1.672	1.807	1.865	1.928	2.000	2.088	2.291
0.45	1.985	0.964	1.103	1.235	1.365	1.500	1.559	1.622	1.693	1.781	1.985
0.50	1.732	0.712	0.850	0.982	1.112	1.248	1.306	1.369	1.440	1.529	1.732
0.55	1.518	0.498	0.637	0.768	0.899	1.034	1.092	1.156	1.227	1.315	1.518
0.60	1.333	0.313	0.451	0.583	0.714	0.849	0.907	0.970	1.042	1.130	1.333
0.65	1.169	0.149	0.287	0.419	0.549	0.685	0.743	0.806	0.877	0.966	1.169
0.70	1.020		0.138	0.270	0.400	0.536	0.594	0.657	0.729	0.817	1.020
0.75	0.882			0.132	0.262	0.398	0.456	0.519	0.59	0.679	0.882
0.80	0.750				0.130	0.266	0.324	0.387	0.458	0.547	0.750
0.85	0.620					0.135	0.194	0.257	0.328	0.417	0.620
0.90	0.484						0.058	0.121	0.193	0.281	0.484
0.95	0.329							0.037	0.126	0.329	

Example:

- a. Consumption of active energy E_W = 300,000 kWh
- b. Consumption of reactive energy E_B = 400,000 kWh
- c. Number of working hours t = 600 h

$$\text{Average active power } P = \frac{300,000 \text{ kWh}}{600 \text{ h}} = 500 \text{ kW}$$

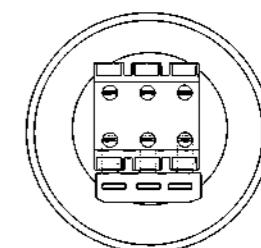
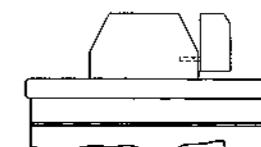
$$\text{Calculation of the original power factor cos}\phi_1: \quad \cos\phi_1 = \frac{1}{\sqrt{\left(\frac{E_B}{E_W}\right)^2 + 1}} = \frac{1}{\sqrt{\left(\frac{400,000 \text{ kWh}}{300,000 \text{ kWh}}\right)^2 + 1}} = 0.6.$$

For the improvement of the power factor from 0.6 to 0.9 we read the factor 0.849 from the above table.
 The required capacitor power is Q_C = 500 kW · 0.849 = 425 kvar.

Accessories

Discharge modules

Four separate discharge modules (82 k Ω , 120 k Ω , 180 k Ω and 300 k Ω) are available for the discharge of single capacitors or groups of several connected capacitors. The resistors are allocated in a finger-proof housing (IP20).



The correct size of the module to be applied can be either taken from the chart below or calculated with the following formula:

1. three-phase capacitors:

$$R = \frac{t}{C_T \cdot I_n \cdot \frac{U_B}{U_E}}$$

t = discharge period in s
 C_T = partial capacitance of one phase
 U_B = operating voltage
 U_E = maximum permissible voltage after period t
 R = module resistance value

2. single-phase capacitors:

$$R = \frac{t \cdot 1.5}{C_{total} \cdot \frac{U_B}{U_E}}$$

C_{total} = total capacitance

In all cases the next smaller value has to be applied.

Example for the selection from the chart:
 A capacitor P_R = 20 kvar U_R = 525 V is operated in a detuned capacitor bank at a mains voltage of U_{mains} = 400 V with a detuning degree of 14 %. It shall be discharged to ≤ 50 V within 40 seconds.

$$1. \text{ calculation of the operating voltage:} \quad U_B = \frac{400 \text{ V}}{(1-0.14)} = 465 \text{ V}$$

$$2. \text{ partial capacitance acc. to data chart MKP 525 V 50 Hz: } C_T = 77 \mu\text{F}$$

From the chart we read that the discharge module 3 x 180 k Ω can discharge a partial capacitance of up to 86 μF from the voltage of U_B = 465 V to ≤ 50 V within the required period.

MPP

440 V / 60 Hz

Permitted operating voltages

permanent overvoltage: 8 h / day:	460 V	between terminals:	880 V AC / 2 s
30 min / day:	480 V	terminals to case:	3000 V AC / 10 s
5 min / 200 times:	510 V		
1 min / 200 times:	530 V		
permitted overvoltage during operation:	570 V		
	1300 V (peak rating)		

Test voltages

SSR	C 22.2 No. 190-M 1985 (L)
NRTL/C	UL No. 810 (L)
	[resin filled types only]

SINGLE PHASE

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	22.9	3.8	6	45 x 151	0.3	A
3.3	45.2	7.5	11	60 x 151	0.5	A
4.17	57.1	9.5	14	65 x 151	0.6	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 11.4	3 x 3.3	3 x 6	60 x 176	0.6	A
5	3 x 22.8	3 x 6.6	3 x 12	75 x 176	1.0	L
7.5	3 x 34.3	3 x 9.8	3 x 18	95 x 176	1.6	L
10	3 x 45.7	3 x 13.1	3 x 24	100 x 176	1.7	L
11.25	3 x 51.4	3 x 14.8	3 x 27	116 x 176	2.3	L
12.5	3 x 57.1	3 x 16.4	3 x 30	116 x 176	2.3	L
14.1	3 x 64.4	3 x 18.5	3 x 33	116 x 176	2.3	L
15	3 x 68.5	3 x 19.7	3 x 31	116 x 230	3.2	L
20	3 x 91.3	3 x 26.2	3 x 42	116 x 230	3.2	L

Harmonic Distortion and Filtering

Developments in modern semiconductor technology have led to a significant increase in the number of thyristor- and converter-fed loads. Unfortunately converters have undesirable effects on the incoming AC supply, drawing appreciable inductive reactive power and a non-sine-wave current. The supply system needs to be kept free of this harmonic distortion to prevent equipment malfunction.

A typical converter current is composed of a mixture of sine-wave currents, a fundamental component at the supply frequency and a number of harmonics whose frequencies are integer multiples of the line frequency (in three phase mains most of all the 5th, 7th, and 11th harmonic). The harmonics lead to a higher capacitor current, because the reactive resistance of a capacitor sinks with rising frequency.

Harmonic distortion of an AC supply can result in any or all of the following:

- Premature failure of capacitors.
- Nuisance tripping of circuit breakers and other protective devices.
- Failure or maloperation of computers, motor drives, lighting circuits and other sensitive loads.

The rising capacitor current can be accommodated by constructional improvements of the capacitor, however resonating circuits between the power factor correction capacitors, the inductance of the feeding transformer and the mains may occur. If the frequency of such a resonating circuit is close enough to a harmonic frequency, the resulting circuit amplifies the oscillation and leads to immense over-currents and over-voltages.

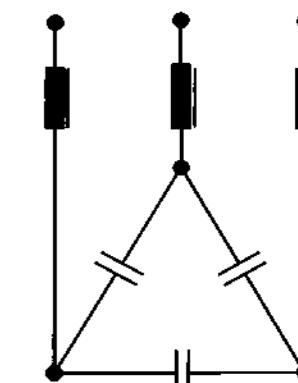
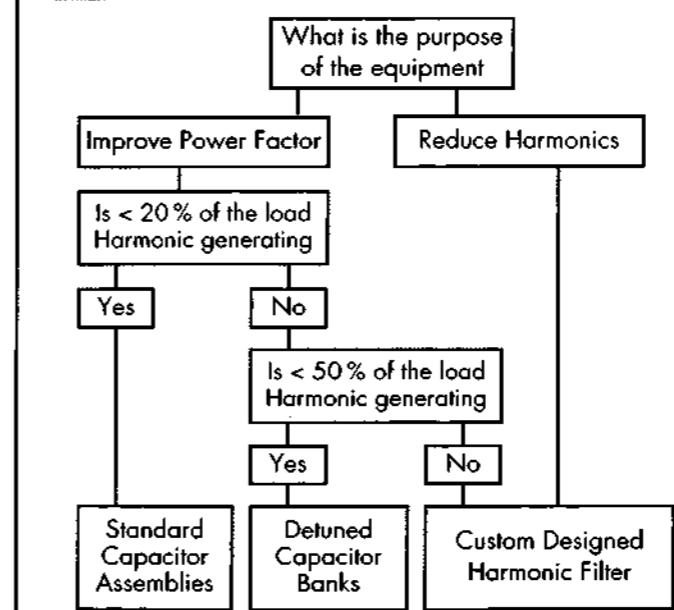
Detuned Filter Banks

The installation of detuned (reactor-connected) capacitors is designed to force the resonant frequency of the network below the frequency of the lowest harmonic present, thereby ensuring no resonant circuit and, by implication, no amplification of harmonic currents. Such an installation also has a partial filtering effect, reducing the level of voltage distortion on the supply, and is recommended for all cases where the share of harmonic-generating loads is more than 20% of the overall load to be compensated.

Tuned Filter Banks:

A filter circuit presents a very low impedance to the individual harmonic current, diverting the majority of the current into the filter bank rather than the supply. The resonance frequency of a tuned capacitor is always below the frequency of the fifth harmonic.

Planning Reactive power compensation



Reactive Power Compensation can be properly planned with the aid of the diagram to the left.

ELECTRONICON

Kondensatoren GmbH



Mounting instructions

MPP

600 V / 60 Hz

Selection of the rated voltage / rated power

The rated voltage of the capacitors indicated in the table below must not be exceeded even in cases of malfunction. Bear in mind that capacitors in detuned equipment are exposed to a higher voltage than that of the rated mains voltage; this is caused by the connection of detuning reactor and capacitor in series.

That is to say

$$U_C = \frac{U_R}{\left(1 - \frac{P}{100\%}\right)}$$

U_R = rated mains voltage
 U_C = capacitor voltage
 P = detuning factor

When calculating the required power of a capacitor, the reactive power of the detuning reactor must also be considered.

Example:

A capacitor with a rated power of 10 kvar 440 V which is 7% detuned and operated in a 400 V mains will deliver a power of only 8.9 kvar. If this capacitor is 5.67% detuned the power output will only be 8.8 kvar.

An alternative can be the special adjustment of the power of capacitor and reactor. For more details see our catalogue "Reactors for Filter Circuits".

Permitted operating voltages

permanent overvoltage:	660 V
8 h / day:	690 V
30 min / day:	720 V
5 min / 200 times:	750 V
1 min / 200 times:	800 V
permitted overvoltage during operation:	2000 V (peak rating)

Test voltages

between terminals:	1290 V AC / 2 s
terminals to case:	3000 V AC / 10 s
NRTL / C	C 22.2 No. 190-M 1985 (L)
	UL No. 810 (L)
	(resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
12.5	92.0	20.8	37.5	116 x 176	2.3	L
20	147	33.3	53.3	116 x 230	3.2	L

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
5	3 x 12.3	3 x 4.8	3 x 9	85 x 176	1.2	L
10	3 x 24.6	3 x 9.6	3 x 17	116 x 176	2.3	L
12.5	3 x 30.7	3 x 12	3 x 22	116 x 176	2.3	L
15	3 x 36.8	3 x 14.4	3 x 26	116 x 176	2.3	L
20	3 x 49.1	3 x 19.2	3 x 31	116 x 230	3.2	L

Current rating

The maximum permitted rms current for each particular capacitor is specified in the data charts. Continuously exceeding these values will lead to increased losses and premature capacitor failure. Higher rms values require adjustments in construction and are available on request.

Our capacitors have been designed for short term inrush currents of up to $100 \times I_R$ as standard. However, when switching capacitors in automatic capacitor banks without detuning reactors higher loads are very often the case. This may have a negative effect on the operational life especially of capacitors which are frequently connected and disconnected (e.g. primary stages). We therefore strongly recommend the use of special capacitor contactors with inrush limiting resistors, or other adequate devices for limitation of the peak inrush currents.

Connection

All cylindrical capacitors are fitted with a "break action" safety mechanism (see above) which may cause the casing to expand, especially at the crimp and at the lid. Such capacitors must only be connected with flexible cables or elastic copper bands. The folded crimps must not be held by retaining clamps. A clearance of at least 10 mm above the terminations must be accommodated.

The following torques should not be exceeded:

terminal connection design L M5 4.5 Nm

stud M8 4 Nm
stud M12 7 Nm

MPP**690 V / 50 Hz****Permitted operating voltages**

	725 V	Test voltages	
permanent overvoltage:		between terminals:	1380 V AC / 2 s
8 h / day:	760 V	terminals to case	4000 V AC / 10 s
30 min / day:	800 V		
5 min / 200 times:	830 V		
1 min / 200 times:	900 V		
permitted overvoltage during operation:	2100 V (peak rating)		

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	11.2	2.4	4	40 x 151	0.2	A
3.3	22.1	4.8	7	60 x 151	0.5	A
4.17	27.9	6.0	9	65 x 151	0.6	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 5.6	3 x 2.1	3 x 4	55 x 176	0.5	A
5	3 x 11.1	3 x 4.2	3 x 8	75 x 176	1.0	L
7.5	3 x 16.7	3 x 6.3	3 x 11	95 x 176	1.6	L
10	3 x 22.3	3 x 8.4	3 x 15	116 x 176	2.3	L
12.5	3 x 27.9	3 x 10.5	3 x 19	116 x 176	2.3	L
15	3 x 33.4	3 x 12.6	3 x 20	116 x 230	3.2	L
20	3 x 44.6	3 x 16.7	3 x 27	116 x 230	3.2	L

MPP**760 V / 50 Hz****Permitted operating voltages**

	760 V	Test voltages	
permanent overvoltage:		between terminals:	1520 V AC / 2 s
8 h / day:	835 V	terminals to case	4000 V AC / 10 s
30 min / day:	875 V		
5 min / 200 times:	910 V		
1 min / 200 times:	1000 V		
permitted overvoltage during operation:	2200 V (peak rating)		

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
10	3 x 18.4	3 x 7.6	3 x 14	116 x 176	2.3	L
12.5	3 x 23	3 x 9.5	3 x 17	116 x 176	2.3	L
13.9	3 x 25.5	3 x 10.6	3 x 19	116 x 176	2.3	L
14.3	3 x 26.3	3 x 10.9	3 x 20	116 x 176	2.3	L
15	3 x 27.6	3 x 11.4	3 x 21	116 x 176	2.3	L

Fuses and Cross Section of Leads

Power capacitors are to be secured with slow-acting fuses. The cross section of the leads should be sized for at least 150 % of the rated capacitor current. (See table for recommended cross sections and fuse dimensions.)

Rated current A	Recommended cross section of connection wires mm ²	Fuse A
6	1.5	10
10	2.5	20
15	4	25
22	6	35
32	10	50
40	16	63
50	25	80

Mounting

Capacitors of a cylindrical design withstand vibration stresses up to 1g. They comply with testing standard FC acc. to DIN IEC 68 pt.2-6 as follows:

test duration: 30 cycles
 frequency range: 10 500 Hz
 max. acceleration: 10 m/s²
 max. displacement amplitude: 0.075 mm

All cylindrical capacitors can be fixed sufficiently using the mounting stud.

Mounting position:

Capacitors in MPP technology and resin-filled MKP capacitors should usually be installed upright with terminals facing upwards; other positions including horizontal are possible but not recommended. Gas filled MKP capacitors can be mounted in any position without restrictions.

Mounting location:

To avoid overheating the capacitors must be allowed to emit their heat losses unhindered and should be shielded from external heat sources. If attenuating circumstances give cause for doubt, special tests should be conducted to ensure that the permitted maximum temperature of the capacitor is not exceeded. It should be noted that the internal heat balance of large capacitors is only reached after a couple of hours.

Cooling

The following table details the maximum permitted ambient temperatures for capacitors of each temperature category.

Temperature category	maximum ambient temperature limits		
	absolute maximum	max. avge. over 24hrs	max. avge. over 365 days
B	45 °C	35 °C	25 °C
C	50 °C	40 °C	30 °C
D	55 °C	45 °C	35 °C

Operation of capacitors at temperatures higher than those permitted will lead to a reduction in the operational life of the unit.

Typically, an increase in the ambient temperature of 7°C will reduce the life of the capacitor by a factor of 50%.

For this reason, capacitors should be mounted where they are not exposed to unnecessary heat sources such as detuning reactors, bus-bars, etc.

It is recommended that to achieve the stated capacitor life, some means of active temperature control (eg. forced cooling, heat exchangers etc.) be employed, especially in compact banks with detuning reactors. Furthermore, we strongly recommend that the capacitors are not placed above or next to detuning reactors.

Earthing:

Capacitors with a metal case must be earthed at the mounting stud or by means of a separate metal strap or clamp.

Discharge:

Capacitors should be discharged to < 10% of the rated voltage prior to being re-energised. For this purpose, special discharge modules are offered for capacitors in design L, which can be selected in accordance with the applied operating voltage and the desired discharge period. Standard IEC 831 requires a discharge to 75V or less within 3 minutes. Note that in automatic capacitor banks shorter discharge cycles may be required.

For very short discharge cycles rapid discharge reactors or switchable discharge resistors may be used.

For more information see page 31.

NOTE: Capacitors must be discharged and short-circuited before working on the terminals.

Disposal:

All ELECTRONICON capacitors are totally free of PCB and do not contain toxic substances.

When disposing of or arranging for the disposal of the capacitors it should be noted that MPP-capacitors are filled with mineral oil. A data sheet about the impregnant can be provided by the manufacturer.

MKP-capacitors are filled with viscous polyurethane resins. The gas-filled capacitors contain only neutral, physiologically sound insulation gases.

525 V / 50 Hz 480 V / 60 Hz

Permitted operating voltages

permanent overvoltage:	550 V
8 h / day:	580 V
30 min / day:	600 V
5 min / 200 times:	630 V
1 min / 200 times:	680 V

permitted overvoltage during operation: 1600 V (peak rating)

Test voltages

between terminals:	1050 V AC / 2 s
terminals to case	3000 V AC / 10 s

 C 22.2 No. 190-M 1985 (L)
NRTL/C UL No. 810 (L)
(resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rat. curr. 525V/50Hz A	Rat. curr. 480V/60Hz A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	19.3	3.2	3.5	5	50 x 151	0.4	A
2.9	33.0	5.4	6.0	9	60 x 151	0.5	A
3.3	38.1	6.3	6.9	10	60 x 151	0.5	A
4.17	48.2	7.9	8.7	13	65 x 151	0.6	A
5.7	66.0	10.9	11.9	18	65 x 185	0.6	A
7.3	84.0	13.8	15.2	23	75 x 225	1.2	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rat. curr. 525V/50Hz A	Rat. curr. 480V/60Hz A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 9.6	3 x 2.7	3 x 3	3 x 5	55 x 176	0.50	A
5	3 x 19.2	3 x 5.5	3 x 6	3 x 11	75 x 176	1.0	L
7.5	3 x 28.9	3 x 8.2	3 x 9	3 x 16	95 x 176	1.6	L
10	3 x 38.5	3 x 11	3 x 12	3 x 22	100 x 176	1.7	L
12.5	3 x 48.1	3 x 13.7	3 x 15	3 x 27	116 x 176	2.3	L
14.8	3 x 57	3 x 16.3	3 x 17.8	3 x 28	116 x 230	3.2	L
15	3 x 57.7	3 x 16.5	3 x 18	3 x 29	116 x 230	3.2	L
18.5	3 x 71.2	3 x 20.3	3 x 22.3	3 x 36	116 x 230	3.2	L
20	3 x 77	3 x 22	3 x 24.1	3 x 38	116 x 230	3.2	L

580 V / 50 Hz

Permitted operating voltages

permanent overvoltage:	610 V
8 h / day:	640 V
30 min / day:	670 V
5 min / 200 times:	700 V
1 min / 200 times:	760 V

permitted overvoltage during operation: 1700 V (peak rating)

Test voltages

between terminals:	1160 V AC / 2 s
terminals to case	3000 V AC / 10 s

 C 22.2 No. 190-M 1985 (L)
NRTL/C UL No. 810 (L)
(resin filled types only)

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
7.5	3 x 23.7	3 x 7.5	3 x 13	95 x 176	1.6	L
10	3 x 31.5	3 x 10	3 x 18	116 x 176	2.3	L
12.5	3 x 39.4	3 x 12.4	3 x 22	116 x 176	2.3	L
14.2	3 x 44.8	3 x 14.1	3 x 23	116 x 230	3.2	L
15	3 x 47.3	3 x 14.9	3 x 27	117 x 230	2.3	L



MPP

440 V / 50 Hz

Permitted operating voltages

permanent overvoltage:	450 V
8 h / day:	480 V
30 min / day:	510 V
5 min / 200 times:	530 V
1 min / 200 times:	570 V
permitted overvoltage during operation:	1300 V (peak rating)

Test voltages

between terminals:	880 V AC / 2 s
terminals to case:	3000 V AC / 10 s
	C 22.2 No. 190-M 1985 (L)
NRTL / C	UL No. 810 (L)
	(resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	27.5	3.8	6	45 x 151	0.3	A
3.3	54.3	7.5	11	65 x 151	0.6	A
4.0	66.0	9.1	14	66 x 151	0.6	A
4.17	68.6	9.5	14	65 x 185	0.6	A
5.1	84.0	11.6	17	75 x 185	1.0	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 13.7	3 x 3.3	3 x 6	60 x 176	0.55	A
5	3 x 27.4	3 x 6.6	3 x 12	85 x 176	1.2	L
7.5	3 x 41.1	3 x 9.8	3 x 18	95 x 176	1.6	L
10	3 x 54.8	3 x 13.1	3 x 24	116 x 176	2.3	L
11.25	3 x 61.7	3 x 14.8	3 x 27	116 x 176	2.3	L
12.5	3 x 68.5	3 x 16.4	3 x 26	116 x 230	3.2	L
14.1	3 x 77.3	3 x 18.5	3 x 30	116 x 230	3.2	L
15	3 x 82.2	3 x 19.7	3 x 31	116 x 230	3.2	L

Construction of the Capacitors

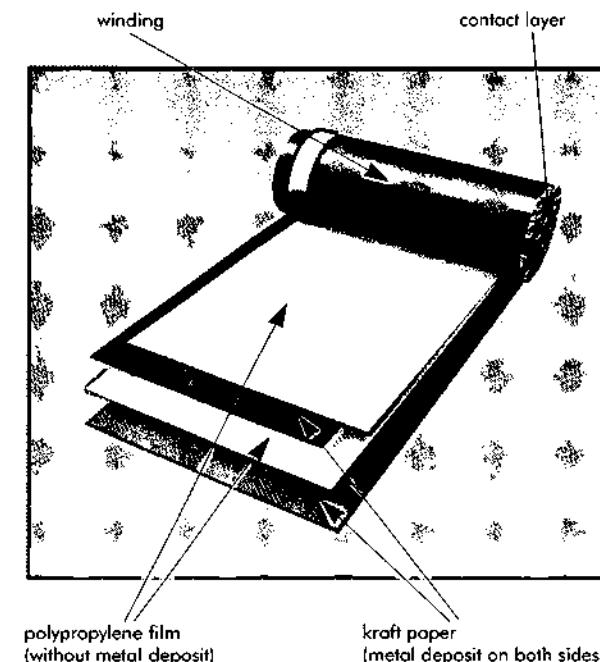
The paper and/or plastic film is wound into stable cylindrical windings. The ends of the capacitor windings are contacted by spraying with a metal contact layer, facilitating a high current load and ensuring a low-inductance connection between the terminals and windings. The cases are made of pressed aluminium and fitted with a mounting stud.

MPP

The dielectric of MPP-type capacitors takes the form of a low-loss polypropylene foil immersed completely in mineral oil. Paper sheets which are metallized on both sides serve as electrodes. MPP-capacitors are dried and impregnated in high vacuum.

Advantages of the MPP technology

- The vacuum drying and impregnation procedure free the dielectric of any voids and minimise the occurrence of partial discharges. This results in long life-expectancy and extremely stable electrical characteristics.
 - The zinc contact layer forms a stable contact with the paper sheets and guarantees a very high resistance to impulse charges (a characteristic well-known from the MP-capacitor) reducing the self-inductance of the capacitor.
 - Extremely low losses through the application of polypropylene dielectric and the metallisation of both sides of the paper.
 - The paper facilitates effective disposal of the products of decomposition, produced as a result of self-healing breakdown. This improves the self-healing qualities of the capacitor.
 - Thanks to its low losses and the heat dissipation qualities of the oil impregnant, the capacitor may be operated at high ambient and case temperatures up to 70°C without effecting the life of the capacitor.
 - MPP power capacitors are particularly suited for use in detuned capacitor equipment.
- The MPP-dielectric is preferred for highly stressed AC capacitors.

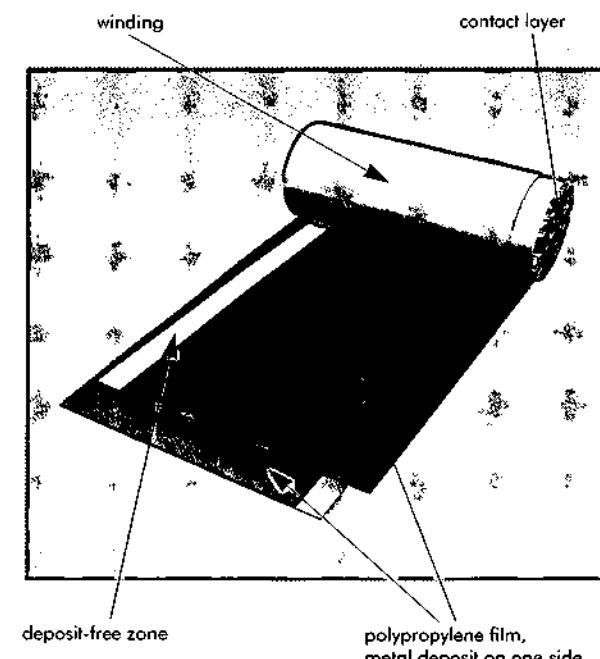


MKP

The MKP-type capacitors consist of a low-loss dielectric formed by pure polypropylene foil. A thin self-healing mixture of zinc and aluminium is metallized directly on one side of the PP-foil under vacuum. This technology ensures a long operating life of the capacitor. In some cases additional unmetallized foils are added between the metallized ones. The capacitor elements are dried in a vacuum. After insertion into the capacitor case, a patented viscous polyurethane resin, mainly containing castor oil, or dried insulation gas, is introduced. This protects the winding from environmental influence and provides an extended life-expectancy and stable capacitance.

Advantages of the MKP technology

- As a result of the comparably simple construction technology, MKP capacitors can be manufactured using less material and consequently enjoy a competitive price level.
- Although they have a thicker dielectric, MKP capacitors usually have smaller dimensions than their MPP-equivalent.
- MKP-type capacitors have a high specific capacitance and a high a.c. load capacity.



Self-healing dielectric

Both dielectric structures described below are "self-healing": In the event of a voltage breakdown the metal layers around the breakdown channel are evaporated by the temperature of the electric arc that forms between the electrodes. They are removed within a few microseconds and pushed apart by the overpressure generated in the centre of the breakdown spot. An insulation area is formed which is reliably resistive and voltage proof for all operating requirements of the capacitor. The capacitor remains fully functional during and after the breakdown.

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Kondensatoren GmbH



Safety of the Capacitors

MPP

415 V / 50 Hz

Protection Against Accidental Contact

All capacitors are checked by routine test [voltage test between terminations and case] in accordance with VDE 0560. Accessible capacitors must be earthed at the bottom stud or with an additional earthing clamp.

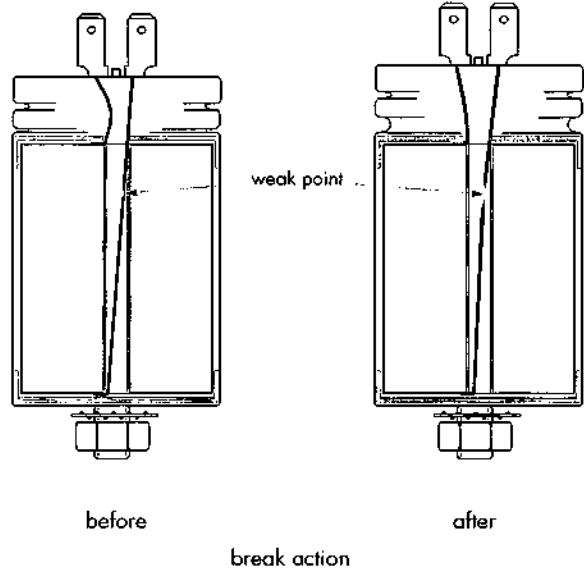
The terminal block of design L is rated IP 20, i.e. it is protected against accidental finger contact with live parts. The discharge modules are designed in the same way (compare page 31).

Protective plastic caps are available for further protection to IP44. Please see page 33 for further details.
Capacitors in design A are not provided with protection against accidental contact as standard. They are available with protective caps on request.

Protection Against Overvoltages and Short Circuits

As shown above, the capacitors are self-healing and regenerate themselves after breakdowns of the dielectric. For voltages within the permitted testing and operating maximum the capacitors are short-circuit- and overvoltage-proof.

Protection against Overload and Failure at the End of Useful Service Life



In the event of overvoltage or ageing at the end of the capacitor's useful service life, an increasing number of self-healing breakdowns may cause rising pressure inside the capacitor. To prevent it from bursting, the capacitor is fitted with an obligatory "break action mechanism". This safety mechanism is based on an attenuated spot at one of the connecting wires inside the capacitor. With rising pressure the case begins to expand, mainly by opening the folded crimp and pushing the lid upwards. As a result, the prepared connecting wire is separated at the attenuated spot, and the current path is interrupted irreversibly.

Permitted operating voltages

permanent overvoltage:	450 V
8 h / day:	460 V
30 min / day:	480 V
5 min / 200 times:	500 V
1 min / 200 times:	540 V
permitted overvoltage during operation:	1250 V (peak rating)

Test voltages

between terminals:	830 V AC / 2 s
terminals to case:	3000 V AC / 10 s

 C 22.2 No. 190-M 1985 (L)
NRTL /C UL No. 810 (L)
(resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	30.9	4.0	6	45 x 151	0.3	A
3.3	61.5	8.0	12	65 x 151	0.6	A
4.17	77.1	10.0	15	65 x 151	0.6	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 15.4	3 x 3.5	3 x 6	60 x 176	0.55	A
5	3 x 30.8	3 x 7	3 x 13	75 x 176	1.0	A
7.5	3 x 46.2	3 x 10.4	3 x 19	95 x 176	1.6	L
10	3 x 61.6	3 x 13.9	3 x 25	116 x 176	2.3	L
12.5	3 x 77	3 x 17.4	3 x 31	116 x 176	2.3	L
15	3 x 92.4	3 x 20.9	3 x 33	116 x 230	3.2	L

MPP**400 V / 50 Hz****Permitted operating voltages**

permanent overvoltage: 8 h / day:	420 V	between terminals:	800 V AC / 2 s
30 min / day:	440 V	terminals to case:	3000 V AC / 10 s
5 min / 200 times:	460 V		
1 min / 200 times:	480 V		
permitted overvoltage during operation:	520 V		
	1200 V [peak rating]	NRTL/C	C 22.2 No. 190-M 1985 (L) UL No. 810 (L) (resin filled types only)

Test voltages

420 V	between terminals:	800 V AC / 2 s
440 V	terminals to case:	3000 V AC / 10 s
460 V		
480 V		
520 V		
1200 V [peak rating]	NRTL/C	C 22.2 No. 190-M 1985 (L) UL No. 810 (L) (resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	33	4.2	6	50 x 151	0.4	A
3.3	66	8.3	12	60 x 151	0.5	A
4.17	83	10.4	16	65 x 151	0.6	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 16.7	3 x 3.6	3 x 6	55 x 176	0.5	A
5	3 x 33.3	3 x 7.2	3 x 13	75 x 176	1.0	L
7.5	3 x 50	3 x 10.8	3 x 19	95 x 176	1.6	L
10	3 x 66.7	3 x 14.4	3 x 26	116 x 176	2.3	L
12.5	3 x 83.3	3 x 18.0	3 x 32	116 x 176	2.3	L
15	3 x 100	3 x 21.7	3 x 35	116 x 230	3.2	L

Designs**Design A**

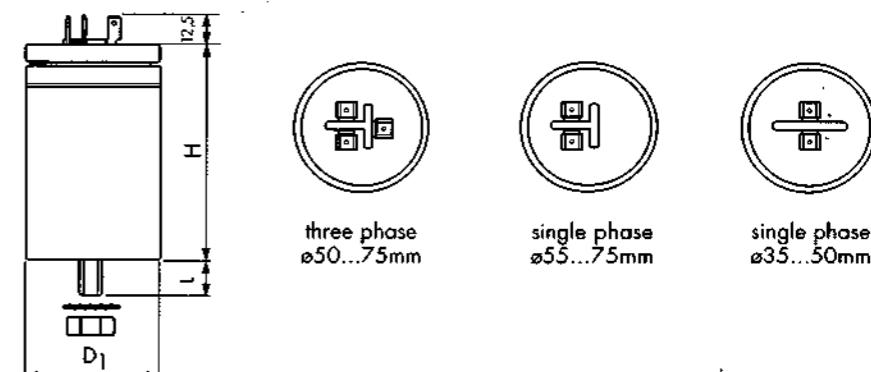
Single phase capacitors with a diameter of 35 ... 75 mm and three phase capacitors with a diameter of 50 ... 75 mm (steps of 5 mm).

Case: pressed aluminium with bottom stud
Lid: plastic lid, casing sealed with rubber gasket
Terminations: dual tab connectors (standard) 6.3 x 0.8 mm
degree of protection: IP00

Size of studs:

D1	screw	L
35 ... 45mm 50 ... 75mm	M8 M12	10 16

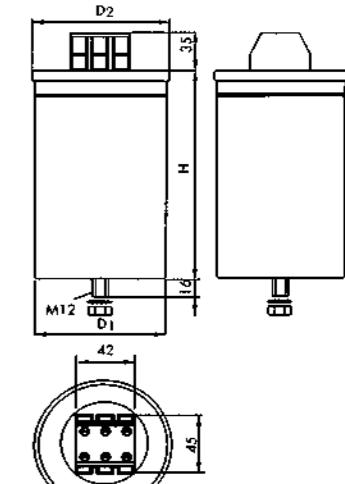
Design A
double tab connectors

**Design L**

Single and three phase capacitors with a diameter of 75 ... 116 mm.

Case: pressed aluminium with bottom stud
Lid: aluminium lid, crimped case
Terminations: terminal block 2 x 25 mm² per phase
Degree of protection: IP20

D1 ⁺¹ -0.5	D2 ⁺¹ -0.5
75	79
85	89
95	100
100	105
116	122



General technical data**Standards:**

IEC 831-1, IEC 831-2, VDE 0560-41,
CSA C22.2 No. 190-M1985,
UL Standard No. 810

MPP TYPES

Rated voltages:	400, 415, 440, 525, 580, 600, 690, 760 V
Rated frequencies:	50/60 Hz
Tolerance of capacitance:	-5 ... +15 %, ± 5 %
Temperature class:	-40°C/D
Maximum surface temperature:	70°C
Maximum permissible current:	see table below, higher values on request

Maximum permissible rate of change of voltage in switching operations: $(dU/dt)_{max}$:

Height (Case)	400 ... 440 V	$(dU/dt)_{max}$		I_{max}
		Rated voltage	Rated voltage	
148 mm	15 V/μs	20 V/μs	30 V/μs	$1.5 \times I_R$
176 mm	30 V/μs	40 V/μs	60 V/μs	$1.8 \times I_R$
230 mm	25 V/μs	35 V/μs	50 V/μs	$1.6 \times I_R$

Losses

Dielectric:	< 0.2 W/kvar
Capacitor:	appr. 0.3 W/kvar (typical data)
Limit loss factor:	$5 \cdot 10^4$
Life expectancy:	100,000 h (permitted failure rate = 3%)

MKP TYPES

Rated voltages:	230, 400, 415, 440, 480, 525 V
Rated frequencies:	50/60 Hz
Tolerance of capacitance:	-5 ... +15 %, ± 5 %
Temperature class:	-25°C/D
Maximum surface temperature:	65°C
Maximum permissible current:	see table below, higher values on request

Maximum permissible rate of change of voltage in switching operations: $(dU/dt)_{max}$:

Height (Case)	230 V	$(dU/dt)_{max}$		I_{max}
		Rated voltage	Rated voltage	
148 mm	10 V/μs	12.5 V/μs	15 V/μs	$1.3 \times I_R$
176 mm	15 V/μs	20.0 V/μs	25 V/μs	$1.6 \times I_R$
230 ... 280 mm	10 V/μs	12.5 V/μs	15 V/μs	$1.5 \times I_R$

Losses

Dielectric:	< 0.2 W/kvar
Capacitor:	appr. 0.3 ... 0.4 W/kvar (typical data)
Limit loss factor:	$5 \cdot 10^4$
Life expectancy:	100,000 h (permitted failure rate = 3%) at temperature level C 70,000 h (permitted failure rate = 3%) at temperature level D

For permitted operating voltages and standard product ranges, see detailed tables.

Permitted operating voltages

permanent overvoltage:	460 V
8 h / day:	480 V
30 min / day:	510 V
5 min / 200 times:	530 V
1 min / 200 times:	570 V
permitted overvoltage during operation:	1300 V (peak rating)

Test voltages

between terminals:	880 V AC / 2 s
terminals to case:	3000 V AC / 10 s
NRTL/C	C 22.2 No. 190-M 1985 (L) UL No. 810 (L) (resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	22.9	3.8	5.3	40 x 148	0.2	A
3.3	45.2	7.5	10.5	50 x 148	0.4	A
4.17	57.1	9.5	13.3	55 x 148	0.5	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 11.4	3 x 3.3	3 x 5	50 x 176	0.4	A
3	3 x 13.7	3 x 3.9	3 x 6	50 x 176	0.4	A
5	3 x 22.8	3 x 6.6	3 x 10	60 x 176	0.6	A
6	3 x 27.4	3 x 7.9	3 x 13	65 x 176	0.6	A
7.5	3 x 34.3	3 x 9.8	3 x 16	75 x 176	1.0	A
10	3 x 45.7	3 x 13.1	3 x 20	75 x 225	1.2	A
10	3 x 45.7	3 x 13.1	3 x 21	85 x 176	1.2	L
12.5	3 x 57.1	3 x 16.4	3 x 25	85 x 230	1.6	L
15	3 x 68.5	3 x 19.7	3 x 30	85 x 230	1.6	L
20	3 x 91	3 x 26.2	3 x 39	95 x 230	1.7	L
25	3 x 114	3 x 32.8	3 x 49	116 x 230	2.4	L
30	3 x 137	3 x 39.4	3 x 59	116 x 230	2.4	L

MKP**400 V / 60 Hz****Permitted operating voltages**

permanent overvoltage:	420 V
8 h / day:	460 V
30 min / day:	505 V
5 min / 200 times:	530 V
1 min / 200 times:	570 V
permitted overvoltage during operation:	1200 V [peak rating]

Test voltages

between terminals:	880 V AC / 2 s
terminals to case:	3000 V AC / 10 s

C 22.2 No. 190-M 1985 (L)
NRTL/C UL No. 810 (L)
[resin filled types only]**SINGLE PHASE**

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	27.7	4.2	6	40 x 85	0.2	A
3.3	54.7	8.3	12	50 x 148	0.4	A
4.17	69.1	10.4	14	55 x 148	0.5	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
5	3 x 27.6	3 x 7.2	3 x 12	60 x 176	0.6	A
10	3 x 55.3	3 x 14.4	3 x 19	65 x 225	0.8	A
10	3 x 55.3	3 x 14.4	3 x 23	85 x 176	1.2	L
12.5	3 x 69.1	3 x 18.0	3 x 29	95 x 176	1.6	L
15	3 x 82.9	3 x 21.7	3 x 32	85 x 230	1.6	L
20	3 x 111	3 x 28.9	3 x 43	95 x 230	1.7	L
25	3 x 138	3 x 36.1	3 x 54	116 x 230	2.4	L
30	3 x 166	3 x 43.3	3 x 65	116 x 230	2.4	L

MKP**230 V / 50 Hz****Permitted operating voltages**

permanent overvoltage:	250 V
8 h / day:	260 V
30 min / day:	270 V
5 min / 200 times:	280 V
1 min / 200 times:	300 V
permitted overvoltage during operation:	800 V [peak rating]

Test voltages

between terminals:	460 V AC / 2 s
terminals to case:	3000 V AC / 10 s

C 22.2 No. 190-M 1985 (L)
NRTL/C UL No. 810 (L)
[resin filled types only]**SINGLE PHASE**

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1	60	4.3	6	45 x 148	0.3	A
1.67	100	7.3	9	60 x 148	0.5	A
2.5	150	10.9	14	60 x 185	0.6	A
3.3	200	14.3	20	75 x 155	0.8	A
5	300	21.7	30	85 x 230	1.7	L
6.7	400	29.1	40	95 x 230	2.1	L
8.3	500	36.1	50	100 x 230	2.4	L
10	600	43.5	60	116 x 230	3.2	L

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 50	3 x 6.3	3 x 9.4	65 x 176	0.6	A
5	3 x 100	3 x 12.6	3 x 19	85 x 230	1.7	L
7.5	3 x 150	3 x 18.8	3 x 28	95 x 230	2.1	L
8.3	3 x 166	3 x 20.8	3 x 31	100 x 230	2.4	L
10	3 x 200	3 x 25.1	3 x 38	116 x 230	3.2	L
12.5	3 x 250	3 x 31.4	3 x 47	116 x 230	3.2	L



MKP**400 V / 50 Hz****Permitted operating voltages**

permanent overvoltage:	420 V	between terminals:	800 V AC / 2 s
8 h / day:	460 V	terminals to case:	3000 V AC / 10 s
30 min / day:	505 V		
5 min / 200 times:	530 V		
1 min / 200 times:	570 V		
permitted overvoltage during operation:	1200 V (peak rating)		

Test voltages

(resin filled types only)

MKP**230 V / 60 Hz****Permitted operating voltages**

permanent overvoltage:	250 V
8 h / day:	260 V
30 min / day:	270 V
5 min / 200 times:	280 V
1 min / 200 times:	300 V
permitted overvoltage during operation:	800 V (peak rating)

Test voltages

between terminals:	460 V AC / 2 s
terminals to case:	3000 V AC / 10 s

(resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	33	4.2	5.4	45 x 148	0.2	A
3.33	67	8.3	11	55 x 148	0.5	A
4.17	83	10.4	14	60 x 148	0.5	A

SINGLE PHASE

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
3.3	165	14.3	20.1	65 x 185	0.6	A
4.17	209	18.1	25.4	75 x 185	1.0	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 16.7	3 x 3.6	3 x 6	50 x 176	0.4	A
5	3 x 33.3	3 x 7.2	3 x 12	65 x 176	0.6	A
7.5	3 x 50	3 x 10.8	3 x 17	75 x 176	1.0	A
10	3 x 66.7	3 x 14.4	3 x 23	75 x 225	1.2	A
10	3 x 66.7	3 x 14.4	3 x 23	75 x 230	1.4	L
12.5	3 x 83.3	3 x 18	3 x 29	85 x 230	1.6	L
15	3 x 100	3 x 21.7	3 x 35	95 x 230	2.1	L
20	3 x 133.3	3 x 28.9	3 x 46	100 x 230	2.4	L
25	3 x 166.7	3 x 36.1	3 x 58	116 x 230	3.2	L

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 41.8	3 x 6.3	3 x 10	65 x 176	0.6	A
5	3 x 83.6	3 x 12.6	3 x 19	75 x 230	1.4	L
7.5	3 x 125	3 x 18.8	3 x 28	95 x 230	2.1	L
10	3 x 167	3 x 25.1	3 x 38	100 x 230	2.4	L
12.5	3 x 209	3 x 31.4	3 x 47	116 x 230	3.2	L
15	3 x 251	3 x 37.7	3 x 56	116 x 230	3.2	L

525 V / 50 Hz 480 V / 60 Hz

Permitted operating voltages

permanent overvoltage:	550 V
8 h / day:	580 V
30 min / day:	600 V
5 min / 200 times:	630 V
1 min / 200 times:	680 V
permitted overvoltage during operation:	1600 V (peak rating)

Test voltages

between terminals:	1050 V AC / 2 s
terminals to case:	3000 V AC / 10 s

 C 22.2 No. 190-M 1985 (L)
NRTL/C UL No. 810 (L)
(resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rat. curr. 525V/50Hz A	Rat. curr. 480V/60Hz A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	19.3	3.2	3.5	5	45 x 148	0.3	A
2.9	33.5	5.5	6.1	8	50 x 148	0.4	A
3.3	38.1	6.3	6.9	9	60 x 148	0.5	A
4.17	48.2	7.9	8.7	11	65 x 148	0.5	A
5.7	65.8	10.9	11.9	15	65 x 185	0.6	A
7.3	84.3	13.9	15.3	20	75 x 225	1.2	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rat. curr. 525V/50Hz A	Rat. curr. 480V/60Hz A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 9.6	3 x 2.7	3 x 3	3 x 5	50 x 176	0.4	A
5	3 x 19.2	3 x 5.5	3 x 6	3 x 10	65 x 176	0.6	A
7.5	3 x 28.9	3 x 8.2	3 x 9	3 x 14	85 x 176	1.2	L
10	3 x 38.5	3 x 11	3 x 12	3 x 18	85 x 230	1.6	L
12.5	3 x 48.1	3 x 13.7	3 x 15	3 x 23	95 x 230	1.7	L
14.8	3 x 57	3 x 16.3	3 x 17.8	3 x 28	116 x 176	2.3	L
15	3 x 57.7	3 x 16.5	3 x 18	3 x 27	95 x 230	1.7	L
18.5	3 x 71.2	3 x 20.3	3 x 22.3	3 x 33	116 x 230	2.4	L
20	3 x 77	3 x 22	3 x 24.1	3 x 36	116 x 230	2.4	L
25	3 x 96.2	3 x 27.5	3 x 30.1	3 x 45	116 x 230	2.4	L

400 V / 50 Hz

Permitted operating voltages

permanent overvoltage:	450 V
8 h / day:	480 V
30 min / day:	510 V
5 min / 200 times:	530 V
1 min / 200 times:	570 V
permitted overvoltage during operation:	1300 V (peak rating)

Test voltages

between terminals:	800 V AC / 2 s
terminals to case:	3000 V AC / 10 s

 C 22.2 No. 190-M 1985 (L)
NRTL/C UL No. 810 (L)
(resin filled types only)

VDE-Reg.-Nr. 10132 (single phase)
VDE-Reg.-Nr. 10140 (three phase)
(resin filled types only)

SINGLE PHASE

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	33	4.2	5.4	45 x 148	0.3	A
3.3	66	8.3	10.7	60 x 148	0.5	A
4.17	83	10.4	13.6	65 x 148	0.5	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance μF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 16.7	3 x 3.6	3 x 6	50 x 176	0.4	A
5	3 x 33.3	3 x 7.2	3 x 12	65 x 176	0.6	A
6.25	3 x 41.7	3 x 9	3 x 14	75 x 176	1.0	A
7.5	3 x 50	3 x 10.8	3 x 17	95 x 176	1.6	L
8.33	3 x 55.5	3 x 12	3 x 19	95 x 176	1.6	L
10	3 x 66.7	3 x 14.4	3 x 23	85 x 230	1.6	L
12.5	3 x 83.3	3 x 18.0	3 x 30	95 x 230	1.7	L
15	3 x 100	3 x 21.7	3 x 35	100 x 230	2.1	L
16.6	3 x 111	3 x 24	3 x 38	116 x 230	2.4	L
20	3 x 133	3 x 28.9	3 x 46	116 x 230	2.4	L
25	3 x 167	3 x 36.1	3 x 58	116 x 280	3.7	L

MKP**415 V / 50 Hz****Permitted operating voltages**

permanent overvoltage:	450 V
8 h / day:	480 V
30 min / day:	510 V
5 min / 200 times:	530 V
1 min / 200 times:	570 V
permitted overvoltage during operation:	1300 V (peak rating)

Test voltages

between terminals:	830 V AC / 2 s
terminals to case:	3000 V AC / 10 s

 C 22.2 No. 190-M 1985 (L)
 UL No. 810 (L)
 (resin filled types) only



VDE-Reg.-Nr. 10140 (three phase)
 (resin filled types) only

SINGLE PHASE

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	30.9	4.0	5.2	45 x 148	0.3	A
3.3	61.5	8.0	10.3	60 x 148	0.5	A
4.17	77.1	10.0	13.1	65 x 148	0.5	A

Permitted operating voltages

permanent overvoltage:	450 V
8 h / day:	480 V
30 min / day:	510 V
5 min / 200 times:	530 V
1 min / 200 times:	570 V
permitted overvoltage during operation:	1300 V (peak rating)

Test voltages

between terminals:	880 V AC / 2 s
terminals to case:	3000 V AC / 10 s

 C 22.2 No. 190-M 1985 (L)
 UL No. 810 (L)
 (resin filled types) only



VDE-Reg.-Nr. 10140 (three phase)
 (resin filled types) only

SINGLE PHASE

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
1.67	27.5	3.8	6	40 x 148	0.2	A
3.3	54.3	7.5	10	55 x 148	0.5	A
4	65.8	9.1	12	60 x 148	0.5	A
4.17	68.6	9.5	12	60 x 148	0.5	A
5.1	83.9	11.6	15	65 x 148	0.5	A

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 15.4	3 x 3.5	3 x 6	50 x 176	0.4	A
5	3 x 30.8	3 x 7	3 x 11	65 x 176	0.6	A
7.5	3 x 46.2	3 x 10.4	3 x 17	85 x 176	1.2	L
10	3 x 61.6	3 x 13.9	3 x 22	85 x 230	1.6	L
12.5	3 x 77	3 x 17.4	3 x 28	95 x 230	1.7	L
15	3 x 92.4	3 x 20.9	3 x 33	95 x 230	1.7	L
20	3 x 123	3 x 27.8	3 x 45	116 x 230	2.4	L
25	3 x 154	3 x 34.8	3 x 56	116 x 280	3.7	L

THREE PHASE (Δ - CONNECTION)

Reactive power kvar	Capacitance µF	Rated current A	max. current A	Dimensions D1 x H mm	Weight kg	Design
2.5	3 x 13.7	3 x 3.3	3 x 5	50 x 176	0.4	A
5	3 x 27.4	3 x 6.6	3 x 10	65 x 176	0.6	A
7.5	3 x 41.1	3 x 9.8	3 x 15	65 x 225	0.8	A
10	3 x 54.8	3 x 13.1	3 x 18	75 x 225	1.2	A
10	3 x 54.8	3 x 13.1	3 x 21	95 x 176	1.6	L
11.25	3 x 61.7	3 x 14.8	3 x 24	96 x 176	1.6	L
12.5	3 x 68.5	3 x 16.4	3 x 25	85 x 230	1.6	L
14.1	3 x 77.3	3 x 18.5	3 x 30	116 x 176	2.3	L
15	3 x 82.2	3 x 19.7	3 x 30	95 x 230	1.7	L
16.7	3 x 91.5	3 x 21.9	3 x 33	116 x 230	2.4	L
20	3 x 110	3 x 26.2	3 x 39	116 x 230	2.4	L
25	3 x 137	3 x 32.8	3 x 49	116 x 230	2.4	L



ELECTRONICON Kondensatoren GmbH has been associated with the manufacture of capacitors in Gera since 1938, when the SIEMENS organisation moved part of its production facility from Berlin to eastern Thuringia in the heart of Germany.

During the past 50 years the company has extended considerably. Continual development in its product ranges has resulted in ELECTRONICON becoming one of Europe's leading capacitor manufacturers supplying customers on all five continents.

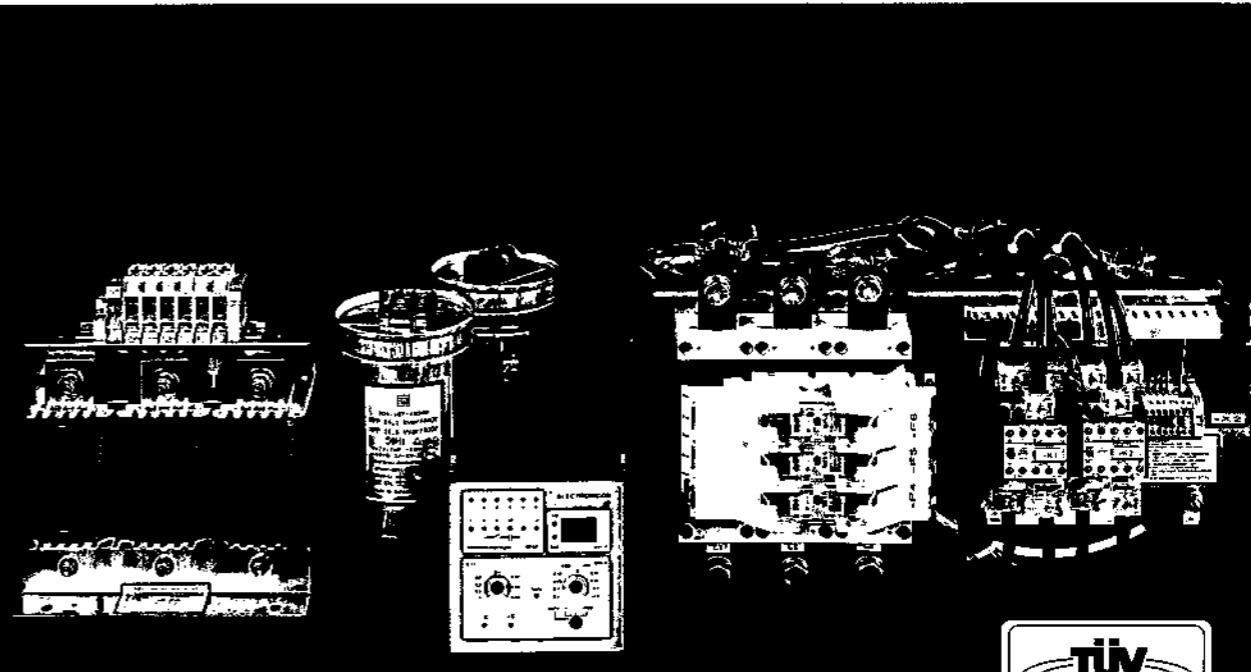
The company employs about 180 qualified engineers and skilled workers in its manufacturing facility, producing capacitors for lighting, motor, and power electronics applications, further components, modules and capacitor banks for power factor correction, and electronic ballasts.

Recent investment in advanced and environmentally sound technologies guarantee the highest standards in manufacture and quality to standards which are approved worldwide. The ELECTRONICON system of quality assurance has been approved by the TUV organisation to ISO 9001.

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ELECTRONICON designs, manufactures and supplies automatic capacitor systems for power factor correction as wall-mounted cabinets for power ratings up to 150 kVAr and as detuned or non-detuned standing cabinets for power ratings up to 1200 kVAr.

All banks made by ELECTRONICON are constructed using a modular design which can easily be extended, enabling further capacitance to be installed cost-effectively.

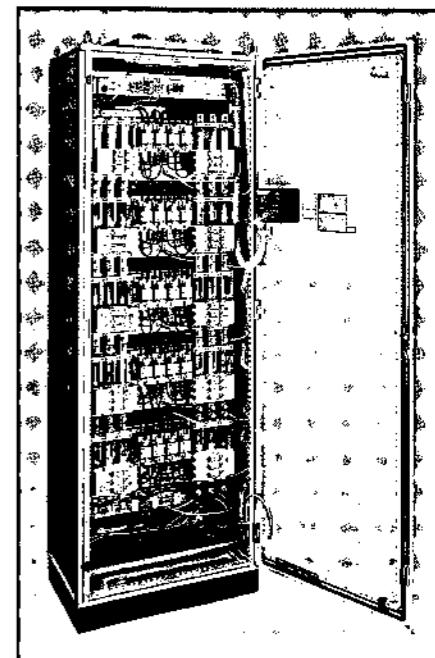
All components used in the equipment have passed an internal approval procedure for reliability, endurance and safety. They include

- oil-impregnated or dry-wound power capacitors (PCB-free), with burst protection ('break-action mechanism')
- special capacitor contactors with inrush limiting feature (in non-detuned banks) by leading manufacturers
- power factor controllers with 4, 6, and 12 outputs tested for high reliability and long operational life, incorporating special features such as harmonic monitoring
- standard or rapid discharge resistors, rapid discharge chokes
- fusing of the capacitor sections by means of HRC fuses or fuse switches (optional)
- special low-loss detuning reactors

Systems can be equipped with audio frequency filters or special reactor combinations to prevent absorption of audio frequency signals transmitted by certain energy supply companies through the mains.

Detuned capacitor banks manufactured by ELECTRONICON are always designed to produce the exact amount of reactive power with relation to the rated system voltage, regardless of what voltage exists inside the system due to the resonance circuitry.

All systems are supplied in a state ready for connection. They are built and tested in accordance with European Standard EN 60439-1.



Our product program

- Power capacitors
- Equipment and modules for power factor correction
- Capacitors for power electronics
- Capacitors for discharge lamps, for parallel and series connection
- Electronic ballasts
- Motor capacitors
- Metallizing of paper and foil

General technical data

Rated voltage	400 ... 690 V, 50 / 60 Hz
Detuning factor	5.67 % / 7 % / 14 % (different values on request)
Ambient conditions	installation in closed locations, max. height 2000 m a.s.l. outdoor installation available on request
Protection	IP 20 / 30 / 43 / 55
Temperature class	T 40
Ambient temperature	+35°C average temp. 24 h +20°C average temp. 365 d -10°C minimum temperature
Applied standards	VDE 0660 pt. 500 / 0106 pt.100, EN 60439-1, IEC 439 / 831
Cabinet size: (L x W x H)	min. 380 x 380 x 150 mm max. 800 x 800 x 2200 mm

In order to provide the best solution for your specific requirements, we need to learn as much as possible about your preferences and network conditions. For our basic information, please answer the questions attached on page 11 of this booklet.

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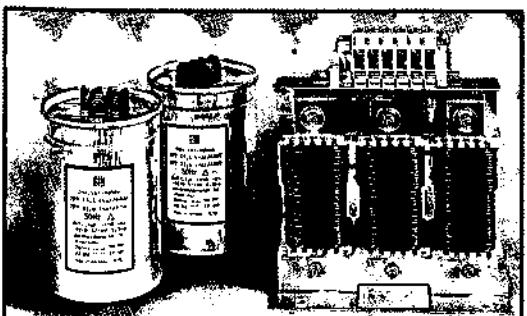
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Assemblies in Kit Form for Detuned Modules

For manufacturers of detuned power factor correction equipment who prefer to have overall responsibility for the design and assembly of their capacitor banks, ELECTRONICON offers suitably rated systems comprising a detuning reactor and a corresponding MPP capacitor.

When installing harmonic blocking filter reactors, the exact capacitance rating of the capacitor with regard to the voltage rise inside the resonating circuit is crucial to ensure safe and error-free operation of the system and to avoid unwanted resonances with harmonics. The required capacitance for such a circuit can be achieved by connecting several small capacitor elements, however, the exact size is unlikely to be achieved. Alternatively, the required capacitance could be achieved by a specially manufactured capacitor of a non-standard rating.



Example: A capacitor rated for 10 kVAr at 400 V / 50 Hz has a capacitance equivalent to 198.9 μ F. When connected in line with a 7 % detuning reactor (creating a series resonance circuit), the voltage at the capacitor's terminals rises to 430 V. Due to the higher voltage, the capacitor now produces a reactive power of 11.61 kVAr / 430 V - in other words the capacitance must now be reduced to 185 μ F to maintain the required output of 10 kVAr / 400 V.

The capacitor must be capable of withstanding this permanent overvoltage. We apply a higher voltage standard (440 V) and install in reality a capacitor with 185 μ F / 440 V / 50 Hz. This capacitor is now rated at 11.25 kVAr / 440 V / 50 Hz.

ELECTRONICON's superior MPP technology ensures a capacitor which is not only extremely resistant to long-term overvoltage and substantial current overload (up to 1.8 I_q), but also has a remarkably stable capacitance throughout its operational life, even under extreme environmental conditions (e.g. high temperature).

Sets of specially rated MPP capacitors with corresponding 7 % detuning reactors are available for the world's most common mains voltages (400 V / 50 Hz, 415 V / 50 Hz, 480 V / 60 Hz).

General Technical Data

Mains voltage	230 ... 525 V 50 / 60 Hz
Capacitor voltage ratings	440 ... 580 V 50 / 60 Hz
Stages	10 / 12.5 / 20 / 25 / 50 kVAr
Capacitor type	MPP

For further information please ask for our special data sheets.

ELECTRONICON Kondensatoren GmbH

has designed, developed and manufactured capacitors in Gera for over half a century. The company is dedicated to the manufacture of products of the highest quality and performance and strives to link traditional expertise and experience with new and innovative solutions. ELECTRONICON is a competent and eager partner both for end-users and manufacturers of power factor correction equipment supplying:

- reliable components and ancillary equipment for assembly purposes (power capacitors, detuning reactors, power factor controllers),
- a customised solution, the optimum combination of detuning reactor, suitably sized capacitor, special contactors, fuses and discharge devices (as a complete module or in kit form), or
- complete banks for Power Factor Correction.

Why use power factor correction equipment ?

Under normal operating conditions certain electrical loads (e.g. induction motors, welding equipment, arc furnaces and fluorescent lighting) draw not only active power from the supply, but also inductive reactive power (kVAr). This reactive power is necessary for the equipment to operate correctly but could be interpreted as an undesirable burden on the supply.

The power factor of a load is defined as the ratio of active power to apparent power, i. e. kW : kVA and is referred to as cos ϕ . The closer cos ϕ is to unity, the less reactive power is drawn from the supply.

If cos ϕ = 1 the transmission of 500 kW in a 400 V three phase mains requires a current of 722 A. The transmission of the same effective power at a cos ϕ = 0.6 would require a far higher current, namely 1203 A. Accordingly, distribution and transmission equipment as well as feeding transformers have to be dimensioned for this higher load. Further, their useful life may decrease.

- For systems with a low power factor the transmission of electric power in accordance with existing standards results in higher expenses both for the supply distribution companies and the consumer.

Another reason for higher expenses are losses incurred via heat dissipation in the leads caused by the overall current of the system as well as via the windings of both transformers and generators.

If we assume for our above example that with cos ϕ = 1 the power dissipated would amount to about 10 kW, then a power factor of 0.6 would result in a 180 % increase in the overall dissipation i. e. 28 kW.

- In general terms, as the power factor of a three phase system decreases, the current rises. The heat dissipation in the system rises proportionately by a factor equivalent to the square of the current rise.

This is the main reason behind why Electricity Supply Companies in modern economies demand reduction of the reactive load in their networks via improvement of the power factor. In most cases, special reactive current tariffs penalise consumers for poor power factor.

Conclusion:

- A reduction in the overall cost of electricity can be achieved by improving the power factor to a more economic level.
- The supply will be able to support additional load which may be of benefit for an expanding company.
- Reducing the load on distribution network components by power factor improvement will result in an extension of their useful life.

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Methods of Power Factor Correction

Opposing capacitive reactive power resulting from the connection of a correctly sized capacitor can compensate for the inductive reactive power required by the electrical load. This ensures a reduction in the reactive power drawn from the supply and is called Power Factor Correction.

Most common methods of power factor correction are:

Single or fixed PFC, compensating for the reactive power of individual inductive loads right on the spot and reducing the load in the feeding leads (typical for single, permanently operated loads with constant and / or big power)

Group PFC - connecting one fixed capacitor to a group of simultaneously operated inductive loads (e. g. group of motors, discharge lamps)

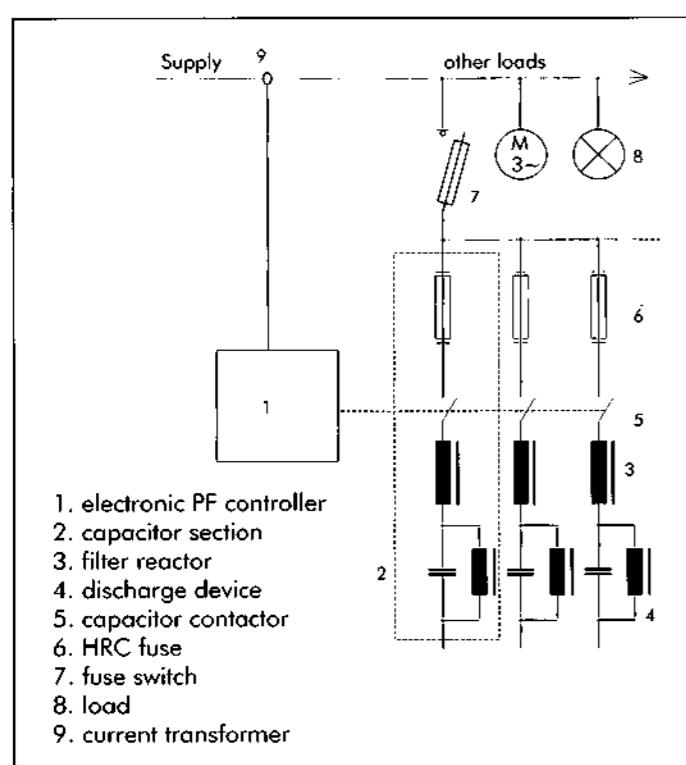
Central PFC, typical for large electrical systems with fluctuating load where it is common to connect a number of capacitors to a main power distribution station or substation. The capacitors are controlled by a microprocessor based relay which continuously monitors the reactive power demand on the supply. The relay connects or disconnects the capacitors to compensate for the actual reactive power of the total load and to reduce the overall demand on the supply.

Automatic (Central) Power Factor Correction

A typical power factor correction system would incorporate a number of capacitor sections determined by the characteristics and the reactive power requirements of the installation under consideration.

Sections of 12.5 kVAr, 25 kVAr, and 50 kVAr are usually employed. Larger stages (e. g. 100 kVAr and above) are achieved by cascading a number of smaller sections. This has the beneficial effect of reducing fluctuations in the mains caused by the inrush currents to the capacitors and minimises supply disturbances. Where harmonic distortion is of concern, appropriate systems are supplied incorporating detuning reactors.

Working Principle of a detuned automatic PFC system



The advantages of centralized power factor correction are:

- the capacitor power is adjusted automatically to the reactive power generated by the inductive loads
- capacitor banks in modular design can easily be extended by new modules and so be adjusted to changing structures in the network
- the functioning of the power factor correction unit can easily be monitored
- better maintenance conditions in comparison with individual power factor correction

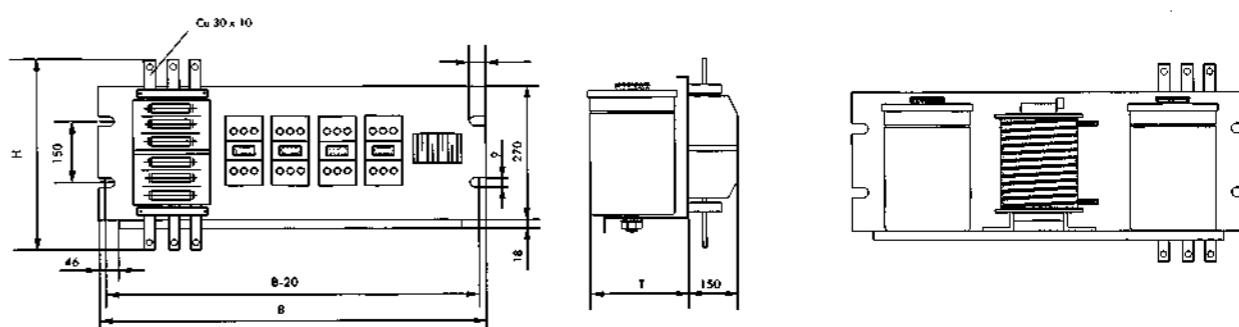
Modules for Power Factor Correction Equipment

ELECTRONICON offers modules for the construction and extension of complex PFC equipment. These modules are prepared for standard-size industrial-style enclosures available from leading manufacturers.

The so-called extension modules incorporate capacitors, contactors, discharge devices and fusegear, and - if necessary - harmonic filter reactors as a backplate assembly, prepared for immediate connection without the need for further modification. This avoids the unnecessary expense of installing further metalwork where the consumer has space available in his distribution board. This option is also very popular with switchboard manufacturers since it enables cost effective assembly of their PFC equipment. It also offers the opportunity to update or extend the installed equipment where necessary by simply exchanging old or inserting new modules.

An extension-module can incorporate terminals, control fuses, transformers, and other equipment for the connection of the automatic power factor controller. These items can also be mounted on an additional control module. This type of module is a pure control unit without capacitors and reactors.

The capacitors in our modules can be oil-impregnated MPP or semi-dry MKP types. For detuned modules MPP capacitors are installed as standard.



General Technical Data

Output	5 ... 100 kVAr
Rated voltage	230 ... 525 V 50 / 60 Hz
Type of protection	IP 00
Electrical connection	bus bar system 60 cables
Fusing device	HRC fuses in closed fuse bases fuse switches
Discharge device	fixed resistors switchable rapid discharge resistors rapid discharge reactors
Capacitor contactors	with or without preload function (inrush protection)
Harmonic filter reactors	special three-phase detuning reactors, designed for required detuning factor
Module width	prepared for standard cabinets with 600 / 800 mm width total 508 / 708 mm (special dimensions available on request)
Module depth	prepared for standard cabinets with 300 / 500 / 600 / 800 mm depth (special dimensions available on request)
Module height including bus bars	320 / 355 / 370 mm (special dimensions available on request)

For further information please ask for our special data sheets.

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UM 2000

Universal measuring device

The growing levels of distortion of modern power distribution networks means that it may now be necessary to monitor even small and medium sized networks.

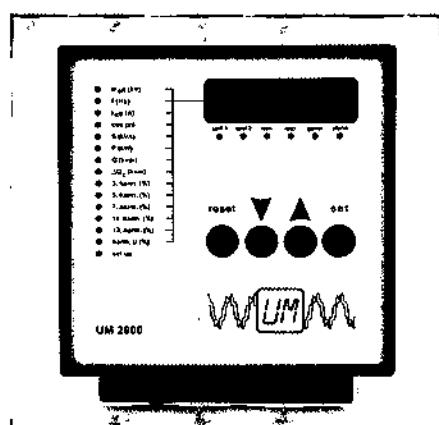
The UM 2000 is based on an electronic single phase measuring system and can be used in three phase networks with symmetrical or nearly symmetrical loads.

The UM 2000 works in all four quadrants and can be connected without regard to phase, phase angle or current direction. The measuring range covers voltages from 58 to 690 V at 50 and 60 Hz, the measuring current range is designed for current transformers of the usual types i.e. .../5 or .../1A.

A specific measuring procedure guarantees reliable data with small tolerances regardless of the waveshape and distortions or the current or voltage waveforms.

The clearly arranged LED display logic provides detailed information about the network parameters, including: voltage, frequency, current, actual and apparent power, reactive power, insufficient capacitor power, THD and individual harmonic voltage and current of the 3rd to 13th harmonics, consumption or generation of energy.

A service program allows the minimum and maximum values of all the parameters measured to be easily read. The UM 2000 can be delivered with a relay for general external alarm or optionally with up to 8 separate alarm relays to signal specific errors. Another optional terminal can receive signals to switch from one tariff regime to another.



PF 2000

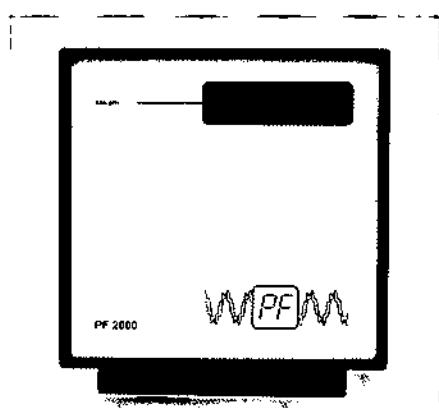
Electronic power factor meter

The use of devices containing power electronics has led to large-scale distortion of most electrical networks.

The PF 2000 power factor meter takes this trend into consideration and - by means of a special measuring method - determines the power factor independently from the actual shape of the sinewave.

The 4-quadrant measuring principle ensures that the power factor is determined correctly whether the power is being imported or exported.

The PF 2000 operates on a single phase measuring system, i.e. in three-phase mains it shows the cosφ of the phase in which the current transformer is installed.



Technical Data UM 2000 / PF 2000

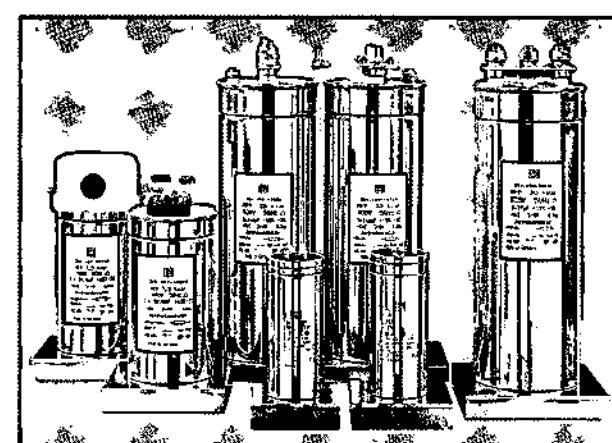
measuring voltage	58 ... 690V
operational voltage	230V (other values on request)
frequency	50/60Hz
measuring current	5A or 1A
measuring tolerance UM 2000 PF 2000	depending on measured value ±1...2.5% ±1 digit max. ±2 digits
casing	for front door mounting
dimensions	144 x 144 x 60mm
connection	multiple contact plug
degree of protection	IP 42, IP 54 on request, contacts IP 20
relay contacts (UM 2000)	max. 250V, 4A
ambient temperature	-10°C...+55°C

Capacitors in MPP and MKP Technology

ELECTRONICON's market knowledge and expertise together with a flexible manufacturing capability ensures that the company is able to offer capacitors for various applications utilising two differing technologies, namely MPP and MKP.

MPP

- kraft paper electrodes metallized on both sides, with polypropylene dielectric, dried in high vacuum and impregnated completely with non-toxic mineral oil
- very resistant against switching surges and steep voltage rise, frequent overcurrent and overvoltage
- long life, high reliability
- low loss level and enhanced thermal conductivity
- very good self-healing ability



MPP capacitors technology is applied mostly to systems with a high proportion of switching operations, high switching overvoltages, and - together with filter reactors - to systems with high harmonic content. MPP capacitors are preferred for P.F.C. equipment with detuning filter reactors and as A.C. filter capacitors.

MKP

- polypropylene foil metallized on one side
- dry winding encapsulated by viscous resin or insulation gas
- compact dimensions and low weight
- resistant to frequent switching operations

The MKP capacitor is suitable for most applications in power factor correction, preferred primarily for non-detuned equipment, and applications on supply networks with low harmonic content.

Both capacitor technologies incorporate self-healing during dielectric breakdowns and are provided with an irreversible over-pressure safety mechanism ('break-action'). Dimensions, testing procedures, performance requirements conform with VDE 0560 pt. 41 and IEC 831-1, IEC 831-2.

General Technical Data

	MPP	MKP
Rated voltages	400, 415, 440, 525, 580, 600, 690 V	230, 400, 415, 440, 480, 525 V
Rated frequencies	50/60 Hz	50/60 Hz
Tolerance of capacitance	-5 ... +15 %, ± 5 %	-5 ... +15 %, ± 5 %
Temperature class	-40°C/D < 20 kVAr -40°C/C ≥ 20 kVAr	-25°C/D < 15 kVAr -25°C/C ≥ 15 kVAr
Max. surface temperature	70°C	60°C
Max. permissible current	1.6...1.8 × I _R , higher values on request	1.4...1.6 × I _R , higher values on request
Losses	Dielectric < 0.2 W/kVAr	< 0.2 W/kVAr
	Capacitor appr. 0.3 W/kVAr (typical value)	0.3 ... 0.4 W/kVAr (typical value)
Limit loss factor	5 · 10 ⁻⁴	5 · 10 ⁻⁴
Life expectancy	> 130,000 h (failure rate = 3 %)	100,000 h (failure rate = 3 %) at temperature level C 70,000 h (failure rate = 3 %) at temperature level D
Approval marks	NRTL /C	NRTL /C

For more detailed information and technical data please see our catalogue "Capacitors for Power Factor Correction".

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Reactors for Detuned Filter Circuits

A consumer whose load includes a high proportion of variable speed motor drives and/or other harmonic generating loads may require a detuned capacitor system. This would perform the function of power factor improvement whilst preventing any amplification of harmonic currents and voltages caused by resonance between capacitors and inductances in the mains.

ELECTRONICON offers single and three phase filter reactors for this purpose.

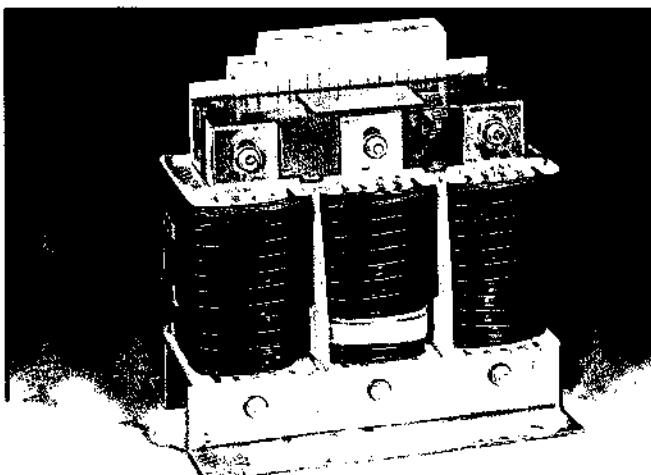
Low-loss reactors are made of specially selected transformer sheets and manufactured in flat or round copper wire technology. They are dried and impregnated in a vacuum which ensures it can withstand high voltages and maintain a long operating life. Reactors can be supplied with aluminium windings on request.

Depending on their rated power, the reactors are provided with either terminal blocks or terminal lugs.

If the operating temperature of 120°C is exceeded, the reactor circuit is disconnected by a thermal switch (included as standard).

Our detuning reactors are available with adjustable and fixed ratings:

- The adjustable reactor is designed to create exactly the required output of reactive power, allowing for the internal voltage rise inside the resonating circuit formed together with the capacitor connected in the circuit. Note that exact sizing of the capacitor is necessary.
- The fixed reactor is matched to a power capacitor with standard rating at mains voltage. This allows for additional installation of detuning reactors in existing non-detuned systems, however, it will lead to increased output of kVAr due to voltage rise inside the resonance circuit.



General Technical Data

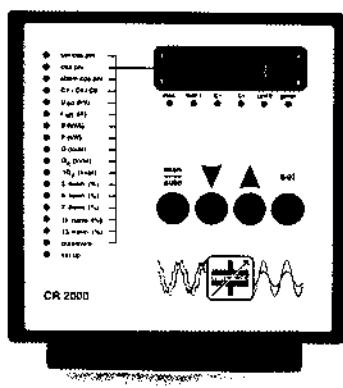
Output Q_C	5 ... 100 kVAr
Rated voltage U_R	230 / 400 / 415 / 440 V
Frequency f_R	50 / 60 Hz
Detuning factor p (standard)	5.67 / 7 / 8 / 12.5 / 14 %
Design	iron core, two air gaps, vacuum resin impregnation
Protection	IP 00
Insulation class	T 40 E
Cooling	natural cooling
Standards	VDE 0550 / 0532, IEC 76
Terminations	terminal blocks or copper lugs
Basis insulation level (winding to core)	3.0 kV
Tolerance of inductance	3 %
Fundamental harmonic load	$I_1 = 1.06 I_R$ (I_R = fundamental harmonic current of the detuned capacitor)
Proportion of harmonics (operational period = 100 %)	$U_3 = 0.5 \% U_R$ $U_5 = 5.0 \% U_R$ $U_7 = 5.0 \% U_R$ (different proportions on request)
Thermal data	$I_{th} = 1.05 I_{rms}$ $I_{th} = 1.168 I_R$
Magnetic load	$I_{lin} = 1.2 (I_1 + I_5 + I_7)$ $I_{lin} = 1.6 \dots 1.8 I_R$ (with $L \geq 0.95 L_R$)

For further information please order our special data sheets "Detuning reactors for PFC Equipment".

Power Factor Controller CONDENSOMATIC - CR 2000

The power factor controller CR 2000 calculates the actual and reactive power in the mains from the measured current and voltage. It also determines if actual power is being consumed or delivered.

The controller identifies the power of the connected capacitor stages and connects or disconnects them in an optimized manner as required by the actual mains conditions. The regulation considers the frequency of changes in the reactive load and follows the principle of rotational switching. This guarantees that optimum power factor correction is achieved with the minimum number of switching operations. It is also possible to determine a fixed capacitor value which is always added to the measured capacitor power. This is useful for the additional compensation of the reactive power of a transformer. The integrated digital display can show the actual power factor, the mains frequency, the actual tariff, the programmed target power factor, the value of present harmonics, the connected and the missing capacitor power. This makes general and specific monitoring of the capacitor bank and its operating conditions possible. The power factor controller CR 2000 is ready for operation with its preset functions immediately after installation without any modifications or adjustments.



Indications of the display

- $\cos\phi$, U , I , S , P , Q , mains frequency
- 3rd...13th harmonic (V und I)
- memory for max values
- connected capacitor power
- missing capacitor power
- connected capacitor branches
- No of switching operations per branch to date
- notification about the reaching of a certain No of switching operations of a branch
- delivery of actual power (e.g. during the operation of generators)
- alarm during insufficient or excessive voltage ($\pm 15\%$ of the rated measuring voltage)

Further properties

- 4-quadrant-operation
- automatical identification of the power of connected capacitors
- optimized switching
- automatic and manual operation
- port for connection of a tariff switch
- seperate setting of target and alarm $\cos\phi$ for two different tariffs
- port for external alarm
- adjustment of the switching periods in dependence of the load
- alarm during insufficient measuring current
- disconnection of the capacitor bank in the event of excessive harmonic voltage distortion
- detection and disconnection of defective capacitor branches (i.e. permanent decrease of 20 % below the initial value)
- variable time for alarm in the event of failed power factor correction (30-300min)
- zero voltage disconnection
- definition of a permanent capacitor value in addition to the measured required power, e.g. for compensation of a transformer
- optional RS 485 port for PC or remote control unit

Technical Data

dimensions (HxWxD)	144 x 144 x 55 mm
required panel cutout	138 x 138 mm (DIN 144)
control voltage	230V
measuring voltage	100 - 525V
measuring current	.../1 to .../5A
No of outputs	4 or 8 (volts free contacts)
external alarm	1 closing contact (volts free contacts)
output contact rating	max. 250V, 1500VA
total switching current	max. 4 A
display elements	numerical display and LEDs
operating elements	4 button foil keyboard
ambient temperature	-20°C...+50°C
protection class	front IP 40, optional IP 54, terminals IP 20
fuses	to be installed externally
mounting position	no restrictions
terminals	multiple contact plug
applicable standards	VDE 0110c, 0160



C



*industrial
controls*



Control switches
Ø 22-30

General features	2
Specifications - Approvals - Degrees of protection	3
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Ø 22 - Round series	
Non-illuminated pushbuttons	8
Illuminated pushbuttons	9
Non-illuminated and illuminated selector switches	10
Joy stick operators and pilot lights	11
Ø 22 - Round series on DIN rail	
Ø 22 - Square series	
Non-illuminated and illuminated pushbuttons - pilot lights	13
Non-illuminated and illuminated selector switches	14
Ø 22 - Thermoplastic round series	
Non-illuminated and illuminated pushbuttons	15
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Non-illuminated pushbuttons - Dual operator pushbuttons	16
Ø 22 - Enclosures without control units	
Ø 30 - Round series	
Non-illuminated pushbuttons	18
Illuminated pushbuttons and pilot lights	19
Non-illuminated and illuminated selector switches	20
Joy stick operators	21
Ø 30 - Enclosures without control units	
Ø 16-22 Round series	
Monolithic - jumbo pilot lights	23
Control stations	24-25
Power supplies: transformers, resistors, flashers	26
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General features



The wide range of Breter control switches offers many solutions of use to control low voltage a.c. or d.c. electrical circuits.

Breter control switches, available in round and square range, appear attractive in design and offer time saving in mounting operations: contact blocks and power supplies have a snap-on fixing system and can be wired separately from the body.

The constructive features and the use of the best standard of materials assure the quality, reliability and safety of Breter control switches, as confirmed by the Approvals granted by the most important Test Houses.

Operator

- metal body.
- thermoplastic body for ø 22 RT and QT series.

Degree of protection - IP 65 according to IEC 529, CEI 70-1.

Surface of operation for pushbuttons - 22 mm dia. square series: 600 mm²
- 22 mm dia. round series : 470 mm²
- 30 mm dia. round series : 470 mm²

Resistance to corrosion

- metal parts withstand corrosion in hot, humid, and saline climate according to IEC 68-2, CEI 50-1, R.I.NA, LLOYD'S specifications.

Limits of temperature - operation from - 20°C to + 55°C (EN 60 947-5-1)
stockage from - 40°C to + 70°C.

Class of insulation

- all versions comply with IEC 536, CEI 23-11 specifications, class II (double insulation).

Resistance to vibrations

- in compliance with LLOYD'S REGISTER OF SHIPPING test requirement and Regolamento R.I.NA.

Power supply

- screw terminal direct power supply BA9s max. 2W lampholder. Insulation rated voltage Ui 250V.

Transformers are manufactured in compliance with IEC 947-5-1 specification, with permanent resistance to short circuit on the secondary. They are impregnated with epoxy resins.



Quality Assurance

Breter works in Quality assurance, to provide the highest quality and reliability required in the most severe high-technology applications (nuclear plants, off-shore, transports, and so on). Quality assurance means that Breter is able to prove and to certificate all products manufacturing phases, in accordance with UNI EN ISO 9001 specification as for CSQ certificate no. 9115.BRE1.



Certificate no.9115.BRE1
UNI EN ISO 9001

Specifications

Breter control switches are manufactured in compliance with EN 60947-1 IEC 947-1, CEI - 23 - 11, CEI 24, IEC 947-5-1, EN 60947-5-1.

They meet all safety and technical requirements in accordance with CEE 73-23 specifications dated February 17, 1972 and 93/68 dated 22 July 93 concerning the free circulation of electrical equipment in the European Common Market.

For safety reason it is essential that Breter control switches are selected, installed and operated strictly in accordance with the limits of duty stated in the catalogue, as well as the national and international specifications concerning the safety of equipment and/or installation to which Breter control switches are fitted.

Breter S.r.l. decline all responsibility for any damage caused by the non-observance of this.

Approvals



CANADA



ITALIAN NAVY REGISTER



USA

Degrees of protection

of low voltage equipment housings according to IEC 529 and CEI 70-1

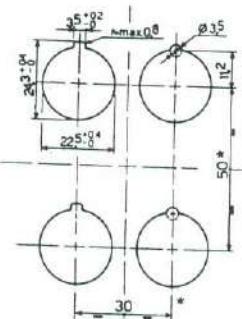
Protection against accidental contacts and against penetration of solid foreign bodies		Protection against penetration of liquids		
symbol	1st figure	Degree of protection	2nd figure	Degree of protection
IP	0	Non-protected	0	Non-protected
	1	Protected against solid objects greater than 50 mm	1	Protected against dripping water
	2	Protected against solid objects greater than 12 mm	2	Protected against dripping water when tilted up to 15°
	3	Protected against solid objects greater than 2.5 mm	3	Protected against spraying water
	4	Protected against solid objects greater than 1.0 mm	4	Protected against splashing water
	5	Dust-protected	5	Protected against water jets
	6	Dust-tight	6	Protected against heavy seas
	—	—	7	Protected against the effects of immersion
	—	—	8	Protected against submersion

Mounting instructions

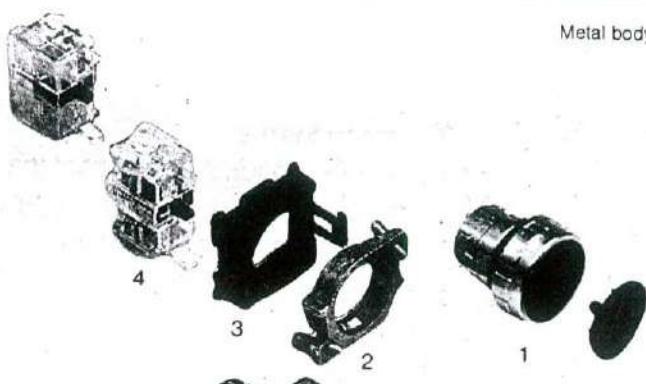
Series Ø 22

- A. Engage the operator (1) into the 22,5 mm dia. mounting hole; it retains itself.
 - B. For metal body operator: hand tighten the bayonet metal ring nut (2) on the operator. For thermoplastic body operator: screw on completely the locking ring (2) from behind
 - C. Snap the contact blocks (4) on the support (3).
 - D. Snap the support (3) complete with contact blocks (4) on the metal ring nut (2).
- Remove contact blocks (4) by simply prying tabs with a screwdriver.

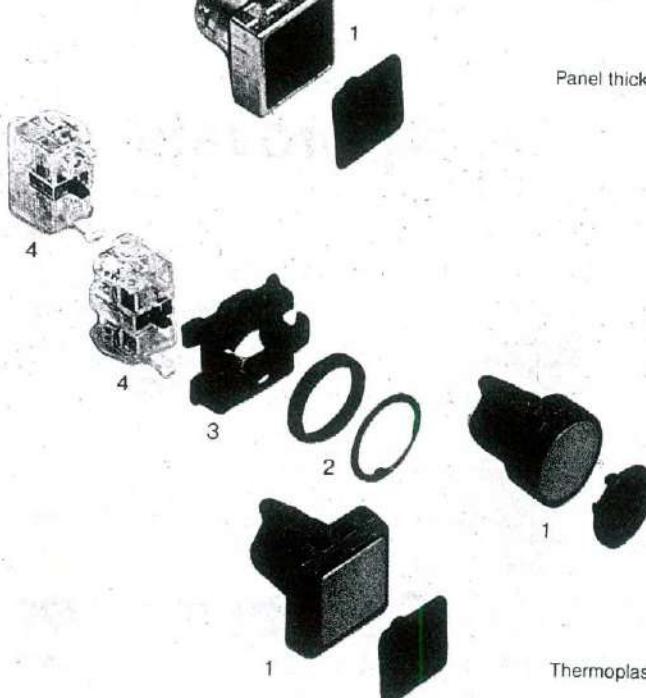
According to CEI 17-14



* min. 42 mm.



Metal body operator

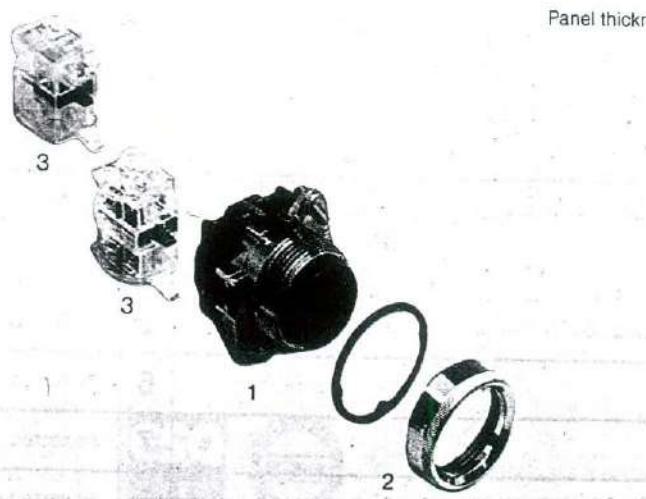
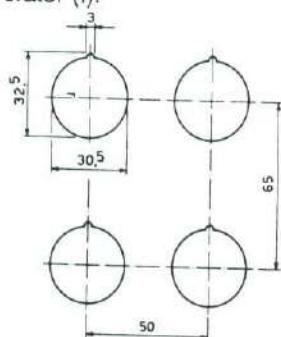


Panel thickness 1 ÷ 6 mm.

Thermoplastic body operator

Series Ø 30

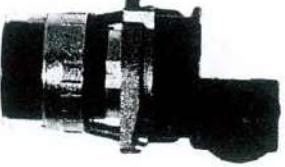
- A. Push the operator (1) into the 30,5 mm dia. mounting hole from behind of the panel.
- B. Engage the operator (1) with the metal chromed ring and the two nuts (2).
- C. Snap the contact blocks (3) on the operator (1).



Panel thickness 1 ÷ 6 mm.

How to order

Breter control switches are consisting of the following basic units:

	1. Operator	2. Contact block	3. Additional power supplies
Non-illuminated operators		+	
Illuminated operators (supplied less lamp)		+	 +  - Transformer - Resistor - Flasher

If you desire to obtain a complete equipment, choose the operator style, colour and action and order the various items under their corresponding part number stated in the catalogue.

All operators are supplied with red and/or black actuator, unless otherwise specified.

Some operators (when specified) can have interchangeable actuators of different colour, to be ordered separately on request.

Illuminated operators are supplied less lamp. To order lamps see Accessories section.

Examples for ordering

Series Ø 22

Red mushroom head momentary pushbutton

RM 050 R

1NC
screw terminal contact block

+ V40

Illuminated flush guard momentary pushbutton with red actuator

RM 122 + P 22814 R

1NC + 1NO
screw terminal contact block

transformer
220/6V

+ V40 + V50 + 570

Serie Ø 30

Flush guard momentary pushbutton with black actuator

M 6010 N

1NO
screw terminal contact block

+ V50

Illuminated flush guard momentary pushbutton with green actuator

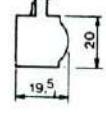
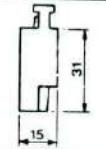
M 6122 V 406

1NC + 1NO
screw terminal contact block

transformer
220/6V

+ V40 + V50 + 570

Contact blocks

	1 NC	1 NO	1 NC LATE BREAK	1 NO EARLY	1 NC+1 NO	
with screw terminals	• V40 • G 1769 ²⁾	• V50 • G 1770 ²⁾	• VR0 • G 2545 ²⁾	• VA0 • G 2546 ²⁾		
with fast-on terminals		• F40 • F50	• FR0	• FA0		
with fast-on terminals					• 210 ¹⁾	

1) Wiring connections should be in same polarity.

2) Base mount plate for control stations PT type

● Normally stocked items

Features

- Make and break self cleaning double break silver nickel contacts, tracking resistant.
- Housing made of transparent and selfextinguishing material permetting visual inspection of contacts.
- Contact blocks may be stacked and snap-mounted in either the upper and/or lower position on the operator.
- Contact blocks are interchangeable and plunger colour indicates contact function.

Terminal capacity

- screw terminals with captive screw and self-lifting clamp: cross section area of rigid single conductor and multi core cables: min. 1 x 0,5 mm² (20 AWG) - max. 2 x 2,5 mm² (14 AWG) or 1 x 3,3 mm² (12 AWG).
- Fast-on terminals to DIN 46247 no. 1 - 6,3 mm, no. 2 - 2,8 mm.

Contact resistance

- ≤ 3 mΩ at 10A.

Short circuit protection

- short circuit rated current with fuse 10A gl = 1 kA EN 60947-5-1 IEC 947-5-1

Terminal identification

- according to CENELEC EN 50013.

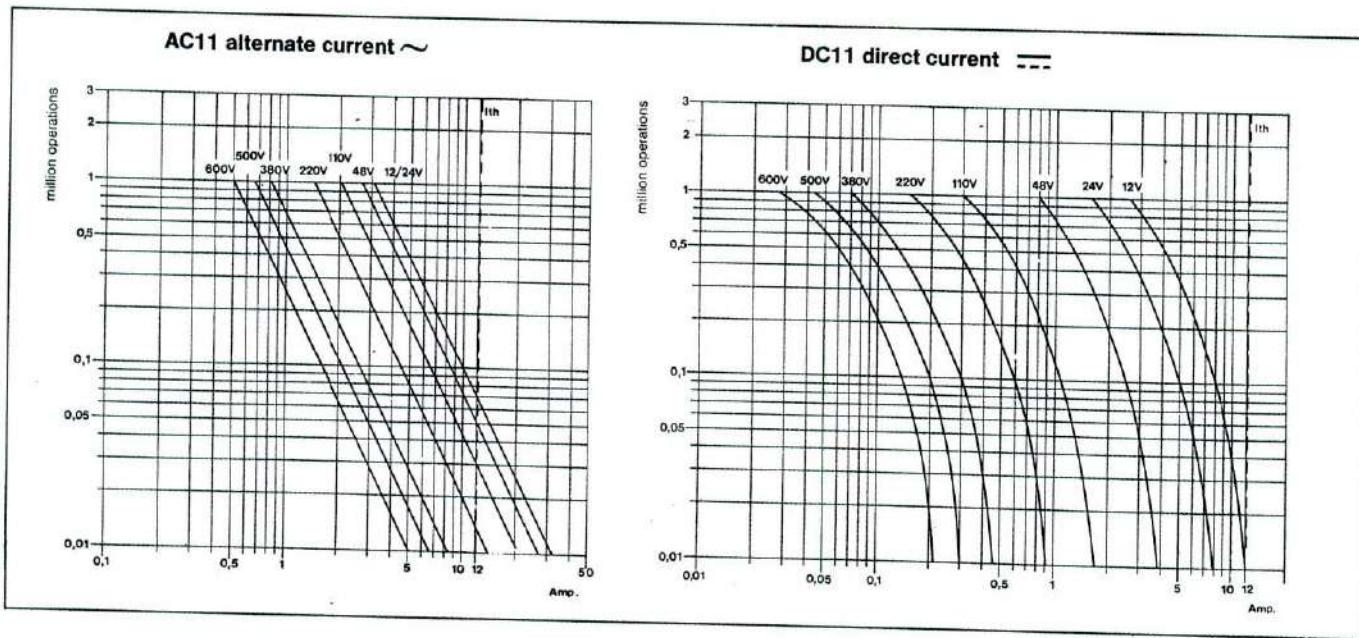
Protection against accidental contacts

- IP 20 if provided with terminal protection device.

Contact blocks

Electrical rating in compliance with		EN 60947 - 1, EN 60947 - 5 - 1, IEC 947 - 1, IEC 947 - 5 - 1										
Insulation rated voltage U_i : 690V		Continuos current rating I_{th} : 12A										
AC 15 control of a.c. solenoids			rated operating voltage	U_e	V	24	48	110/120	250	400	500	600
			rated operating current	I_e	A	10	8,5	6,5	4,5	2,6	2,1	1,6
DC 13 control of d.c. solenoids			rated operating voltage	U_e	V	24	48	120	250	440	500	600
			rated operating current	I_e	A	4	2	1,1	0,55	0,31	0,27	0,2

Operational diagrams



Approvals

MODEL			
V40 - V50 F50 - F40	LR20785- 18	E45364 SEC. 5 6 A - 600 Vac General Use 6 A - 125 Vdc	5/5/78 10 (4) A - 380 Vac +++
	1) A 600 (HD) - P 600 (SD) Pilot Duty		
VA0 - FR0 FA0 - VR0	6 A - 600 Vac 4 A - 125 Vdc	General Use 1) A 600 (HD) - P 150 (SD) Pilot Duty	AC11 - 4,5 A 220 Vac (IEC 337 - 1) 2,6 A 380 Vac
210	LR - 20785 - 9 300 Vac - 110 dc max Standar Duty 10 A - 300 Vac General purpose	E45364 SEC. 1 300 VAC - 120 DC max. Standar Duty	

1) Code designation: A600: (AC) Heavy Duty, P 600: (DC) Standart Duty; P 150: (DC) Standart Duty

Ø 22 - Round series

Momentary pushbuttons

	Operator part. no.	Colour normally supplied	Actuators to be ordered separately	
	• RM 010 1) flush guard	red and black	green yellow blue white	P 22804 V P 22804 G P 22804 A P 22804 B
	• RM 020 R extended button		black green yellow blue white	P 22805 N P 22805 V P 22805 G P 22805 A P 22805 B
	• RM 050 R momentary mushroom head 2)	red		
	RM 050 N	black		
	• RM 055 R (Ø 40) RM 055 N (Ø 40) RM 056 R (Ø 60) wobble mushroom head 2)	red black red		Ø 40=28 Ø 60=32
	RM 054 R wobble joy stick	red		62

Maintained pushbuttons

	RM 030 flush guard push-on / push-off 3)	actuator be ordered separately	red black green yellow blue white	P 24728 R P 24728 N P 24728 V P 24728 G P 24728 A P 24728 B	21,5
	RM 045 R mushroom head push-on / push-off 3)		red		29
	RM 045 N		black		40
	• RM 065 R (Ø 40) • RM 066 R (Ø 60) mushroom head turn to reset 2)		red		Ø 60=32 Ø 40=29

1) Either red and black actuators are supplied with RM 010 operator.

REMARK:

2) When used for emergency purpose, use yellow legend plate.

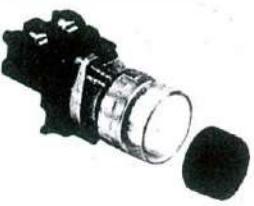
To order operators with black chromed ring add "CN" to part no. Eg. RM 010 CN.

3) Contact blocks to be used: VA0-FA0 V40-F40 max. 4 contacts.

• Normally stocked items

Ø 22 - Round series

Illuminated momentary pushbuttons

	Operator part no.	Colour normally supplied	Actuators to be ordered separately	
 flush guard	• RM 122	actuator to be ordered separately	red green yellow blue orange transparent	P 22814 R P 22814 V P 22814 G P 22814 A P 22814 L P 22814 T
 extended button	• RM 120 R	red	green yellow blue orange transparent	P 22814 V P 22814 G P 22814 A P 22814 L P 22814 T
 momentary mushroom head	RM 150 R	red	green yellow	P 22818 V P 22818 G

Illuminated maintained pushbuttons

 flush guard push-on / push-off 1)	RM 130	actuator to be ordered separately	red green yellow blue transparent	G 2520 R G 2520 V G 2520 G G 2520 A G 2520 T
 mushroom head push-on / push-off 1)	RM 145 R	red	green yellow	G 2521 V G 2521 G
 mushroom head turn to reset	RM 165 R	red		

1) Contact blocks to be used:  V40 - F40  VA0 - FA0 max. 2 contacts.
REMARK: To order operators with black chromed ring add "CN" to part no. Eg. RM 122 CN.

● Normally stocked items

Ø 22 - Round series

Non-illuminated and illuminated selector switches

		Contact closure sequence											
		0	1	2	0	1	2	0	1	2	0	1	
upper contact block	V40 - F40 1 NC		X		X		X		X X				
	V50 - F50 1 NO			X		X		X X		X X			
	VR0 - FR0 1 NC		X		X X		X X		X X				
	V40 - FA0 1 NC			X	X X		X X	X X	X X				
lower contact block	V40 - F40 1 NC		X		X		X		X X				
	V50 - F50 1 NO			X		X		X X		X X			
	VR0 - FR0 1 NC		X		X X		X X		X X				
	V40 - FA0 1 NC			X	X X	X	X	X	X				
keylock	0	1	• RM 200 N										
	0	[1]	• RM 201 N										
	0	← 1	RM 250 N										
	0	1	RM 204 N										
	0	[1]	RM 205 N										
	0	← 1	RM 254 N										
	2	0	1	• RM 210 N									
	[2]	0	[1]	RM 230 N									
	[2]	0	← 1	RM 270 N									
	2	→ 0	← 1	RM 280 N									
black short handle	0	1	• RM 300 N										
	0	← 1	RM 350 N										
	0	1	• RM 304 N										
	0	← 1	RM 354 N										
	2	0	1	• RM 310 N									
	2	0	← 1	RM 370 N									
	2	→ 0	← 1	RM 380 N									
black long handle	0	1	• RM 400 N										
	0	← 1	RM 450 N										
	0	1	• RM 404 N										
	0	← 1	RM 454 N										
	2	0	1	• RM 410 N									
	2	0	← 1	RM 470 N									
	2	→ 0	← 1	RM 480 N									
illuminated 3)	0	1	• RM 650 X										
	0	← 1	RM 655 X										
	0	(90°) 1	RM 651 X										
	2	0	1	• RM 653 X									

1) To obtain a single pole 3-step switch without 0 position use 2NC + 1NO
 2) To obtain a start-stop selector switch, use 1NC + 1NO
 3) Colours available: red (R), green (V), yellow (G), blue (A), white (B); to order replace X with letter in brackets.

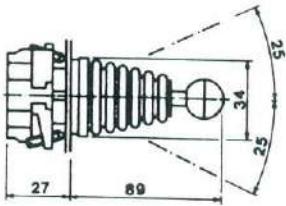
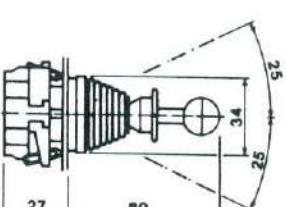
REMARK:
 To order operators with black chromed ring add "CN" to part no.

● Normally stocked items

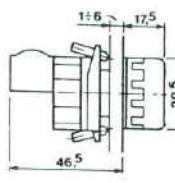
Ø 22 - Round series

Joy stick operators 1)

		Contact closure sequence						
		2	0	1	3	2	0	1
upper contact block	V40 - F40 1 NC			X			X	
	V50 - F50 1 NO		X			X		
	V40 - FA0 1 NC	X	X		X	X	X	X
lower contact block	V40 - F40 1 NC		X		X			
	V50 - F50 T NO			X				X
	V40 - FA0 1 NC	X	X		X	X	X	X
no latch	2 0 1		M 2530 NM					
	2 → 0 ← 1		M 2531 NM					
	3 2 0 1 4			M 2550 NM				
	3 2 → 0 ← 1 4			M 2551 NM				
with mechanical latch in "0" position	2 0 1		M 2570 NM					
	2 → 0 ← 1		M 2571 NM					
	3 2 0 1 4			M 2580 NM				
	3 2 → 0 ← 1 4			M 2581 NM				

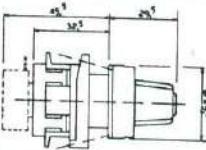



Pilot lights

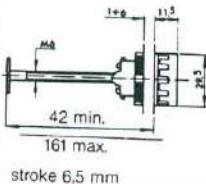
	Part no.	Colour	Lens	
 <p>accepts additional power supplies</p>	RM 600	lens to be ordered separately	red P 22821 R green P 22821 V yellow P 22821 G blue P 22821 A orange P 22821 L transparent P 22821 T	

Ø 22 - Round series

Potentiometric control

	Metal Operator part no.	Thermoplastic Operator part no.	Colour normally supplied	Actuators to be ordered separately	
	suitable for potentiometer with Ø 6 mm min. shaft (potentiometer not supplied).	RM 910	—	black	

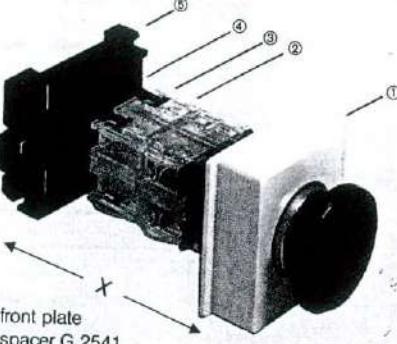
Reset pushbutton

	G 2557	G 2556	white (with black symbol)	Without symbols	
				red	P 22804 R
				black	P 22804 N
				green	P 22804 V
				yellow	P 22804 G
				blue	P 22804 A
				white	P 22804 B
					

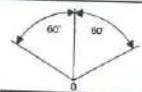
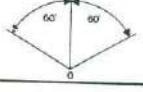
Ø 22 - Round series for mounting on DIN rail

and front plate for panels with standard 45 mm holes
(opaque and luminous metal operators with direct supply only)

Composition

	To obtain a control switch or signaling for mounting on DIN 46277/3 rail with an (X) available depth, order the following:
	X = mm.
	45 58 70
• Operator	1 1 1
• Nº of contact blocks 1)	1 2 1 2 1 2 3 4
• Nº of additional spacers	— — 1 1 — — — —
type G 2539 (h = 12.5 mm)	— — 1 1 — — — —
type G 2540 (h = 5 mm)	— — — — 1 1 1 1
type G 2541 (h = 20 mm)	1 — 1 — 3 2 1 —
• Contact mounting support G 2538	1 1 — —
• Mounting plate for DIN rail G 2535	1 1 — —
• Front plates (see below)	1 1 1

Front plates

	Code		Code	
P 24920	blank		P 25143	
P 25141	0 1		P 25144	OFF ON
P 25142	2 0 1		P 25145	0 1

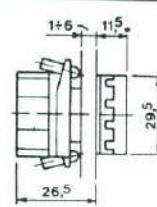
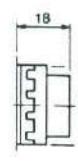
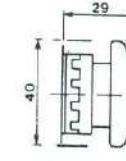
Example for ordering for dimension X = 58 mm

Order: RM 050R + G1769 + 1 G2541 and 1 G2539 + G2538 + G2535 + P 24920

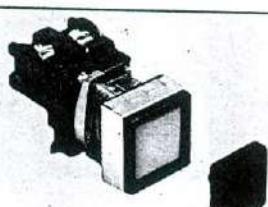
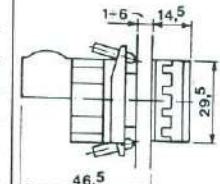
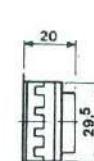
1) Remark: The contact and direct supply bulb holder, if used, must have screw terminals turned 180°.
The new codes are: contacts 1NC = G1769, 1NO = G1770, direct supply = G2134

Ø 22 - Square series

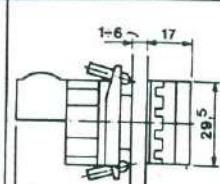
Momentary pushbuttons

	Operator part no.	Colour normally supplied	Actuators to be ordered separately	
	• QM 010 1)	red and black	green P 22857 V yellow P 22857 G blue P 22857 A white P 22857 B	
	• QM 020 R	red	black P 22858 N green P 22858 V yellow P 22858 G blue P 22858 A white P 22858 B	
	• QM 050 R	red		

Illuminated momentary pushbuttons

	Operator part no.	Colour normally supplied	Actuators to be ordered separately	
	• QM 122	actuator to be ordered separately	red T 1001 R green T 1001 V yellow T 1001 G blue T 1001 A orange T 1001 L transparent T 1001 T	
	• QM 120 R	red	green T 1002 V yellow T 1002 G blue T 1002 A orange T 1002 L transparent T 1002 T	

Pilot light

  accepts additional power supplies	• QM 600	lens to be ordered separately	red P 22853 R green P 22853 V yellow P 22853 G blue P 22853 A orange P 22853 L transparent P 22853 T	
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1) Either red and black actuators are supplied with QM 010 operator.

2) When used for emergency purpose, use yellow legend plate.

3) Use lamp 23 mm max length

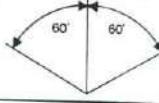
REMARK:

To order operators with black chromed ring add "CN" to part no. Eg. QM 020 RCN.

● Normally stocked items

Ø 22 - Square series

Non-illuminated and illuminated selector switches

		Contact closure sequence							
		0	1	2	0	1	2	0	
upper contact block	V40 - F40 1 NC		X		X		X	XX	
	V50 - F50 1 NO			X		X	X		
	VR0 - FR0 1 NC		X		XX		XX	XX	
	V40 - FA0 1 NC			X	XX		XX	XX	
lower contact block	V40 - F40 1 NC		X			X	X		
	V50 - F50 1 NO			X		X	X	X	
	VR0 - FR0 1 NC		X		XX	X	XX	XX	
	V40 - FA0 1 NC			X	XX	X	X	X	
									
keylock	0	1	QM 200 N						
	0	□	QM 201 N						
	0	← 1	QM 250 N						
	0	1	QM 204 N						
	0	□	QM 205 N						
	0	← 1	QM 254 N						
	2	0	1	QM 210 N					
	2	0	□	QM 230 N					
	2	0	← 1	QM 270 N					
	2	→ 0	← 1	QM 280 N					
black short handle	0	1	QM 300 N						
	0	← 1	QM 350 N						
	0	1	QM 304 N						
	0	← 1	QM 354 N						
	2	0	1	QM 310 N					
	2	0	← 1	QM 370 N					
	2	→ 0	← 1	QM 380 N					
	QM 312 N ₁	QM 372 N	QM 383 N ₂)	QM 313 N	QM 373 N	QM 383 N ₂)			
black long handle	0	1	QM 400 N						
	0	← 1	QM 450 N						
	0	1	QM 404 N						
	0	← 1	QM 454 N						
	2	0	1	QM 410 N					
	2	0	← 1	QM 470 N					
	2	→ 0	← 1	QM 480 N					
	QM 412 N ₁	QM 472 N	QM 483 N ₂)	QM 413 N	QM 473 N	QM 483 N ₂)			
illuminated 3)	0	1	QM 650 X						
	0	← 1	QM 655 X						
	0	(90°) 1	QM 651 X						
	2	0	1	QM 653 X					
	QM 656 X	QM 657 X	QM 658 X	QM 659 X	QM 660 X	QM 661 X	QM 662 X	QM 663 X	QM 664 X

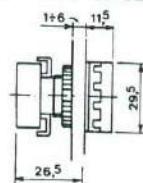
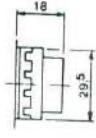
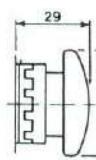
1) To obtain a single pole 3-step switch without a position, use 2NC + 1NO
 2) To obtain a start-stop selector switch, use 1NC + 1NO

3) Colours available: red (red), green (V) - yellow (G), blue (B), white (W).
 To order replace X with letter in brackets.
 REMARK:
 To order operators with black chromed ring, add "CN" to part no.

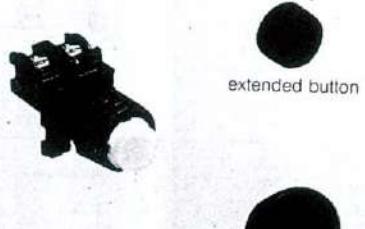
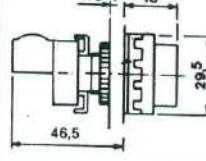
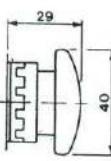
● Normally stocked items

Ø 22 - Thermoplastic round series

Momentary pushbuttons

	Operator part no.	Colour normally supplied	Actuators to be ordered separately	
 flush guard	• RT 010	actuator to be ordered separately	red P 22804 R black P 22804 N green P 22804 V yellow P 22804 G blue P 22804 A white P 22804 B	
 extended button		actuator to be ordered separately	red P 22805 R black P 22805 N green P 22805 V yellow P 22805 G blue P 22805 A white P 22805 B	
 momentary mushroom head	• RT 050 R	red		

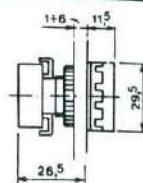
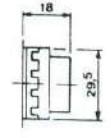
Illuminated momentary pushbuttons

 extended button	• RT 120	actuator to be ordered separately	red P 22814 R green P 22814 V yellow P 22814 G blue P 22814 A orange P 22814 L transparent P 22814 T	
 momentary mushroom head		actuator to be ordered separately	red P 22818 R green P 22818 V yellow P 22818 G	

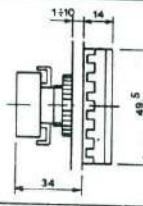
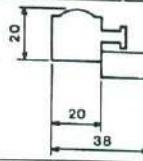
● Normally stocked items

Ø 22 - Thermoplastic square series

Momentary pushbuttons

	Operator part no.	Colour normally supplied	Actuators to be ordered separately													
 flush guard	• QT 010	actuator to be ordered separately	<table> <tr><td>red</td><td>P 22857 R</td></tr> <tr><td>black</td><td>P 22857 N</td></tr> <tr><td>green</td><td>P 22857 V</td></tr> <tr><td>yellow</td><td>P 22857 G</td></tr> <tr><td>blue</td><td>P 22857 A</td></tr> <tr><td>white</td><td>P 22857 B</td></tr> </table>	red	P 22857 R	black	P 22857 N	green	P 22857 V	yellow	P 22857 G	blue	P 22857 A	white	P 22857 B	
red	P 22857 R															
black	P 22857 N															
green	P 22857 V															
yellow	P 22857 G															
blue	P 22857 A															
white	P 22857 B															
 extended button		actuator to be ordered separately	<table> <tr><td>red</td><td>P 22858 R</td></tr> <tr><td>black</td><td>P 22858 N</td></tr> <tr><td>green</td><td>P 22858 V</td></tr> <tr><td>yellow</td><td>P 22858 G</td></tr> <tr><td>blue</td><td>P 22858 A</td></tr> <tr><td>white</td><td>P 22858 B</td></tr> </table>	red	P 22858 R	black	P 22858 N	green	P 22858 V	yellow	P 22858 G	blue	P 22858 A	white	P 22858 B	
red	P 22858 R															
black	P 22858 N															
green	P 22858 V															
yellow	P 22858 G															
blue	P 22858 A															
white	P 22858 B															

Momentary dual operator pushbutton

 non-illuminated IP 40	• QT 011	green I red O	red black green	P 24291 R 1) P 24291 N 1) P 24291 V 1)	
 direct supply to obtain warning light from QT 011	G 2380				
 seal cap IP 66		P 24293			

1) Actuators without symbols

● Normally stocked items

Ø 22 - Enclosures without control units

	IP	No.of holes	grey cover	yellow cover		
 thermoplastic material 1)	54	1	• CT 7022	• CT 7023		

	IP	No.of holes	grey cover	yellow cover	dimensions A B	
 thermoplastic material 1)3)	65	1	• PT22 - 1H	• PT22 - 1G	72 59	
		2	• PT22 - 2		105 92	
		3	• PT22 - 3		138 125	

	IP	covers with knockouts at hole locations No.of holes	covers without holes low	boxes	dimensions A B C D		
 sealed fiberglass polyester resin 2)	65	1 • P 1B - 0122 2 • P 2B - 0222 3 • P 2B - 0322 4 P 2B - 0422 6 P 2B - 0622	• P 1B • P 2B — — — • P 3B • P 4B P 5B	P 1A P 2A — — — — — P 6A P 8A	• C1 • C2 • C2 • C2 • C3 • C4 C5 C6 C8	91 91 71 46 151 91 71 106 151 91 71 106 151 91 71 106 204 91 71 159 256 91 71 211 360 91 71 315 204 169 149 159 290 257 237 245	 C1,C2,C3 - Pg 16 C4,C5,C6 - Pg 21 C8 - Pg 29

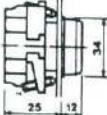
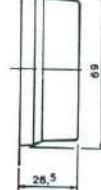
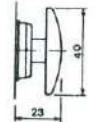
1) Boxes with knockout for PG 13.5 cable gland (part no. G 2519) or Ø 21 grommets (part no. P 9695).
2) Self extinguishing, withstands shocks and chemical agents.

3) For base mounting of contact blocks, pls order also mounting cover plate P 25461.

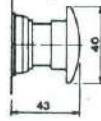
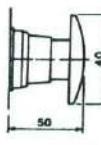
● Normally
stocked items

Ø 30 - Round series

Momentary pushbuttons

	Operator part no.	Colour of actuator	
	<ul style="list-style-type: none"> • M 6010 R red • M 6010 N black • M 6010 V green • M 6010 G yellow • M 6010 A blue • M 6010 B white 		
	<ul style="list-style-type: none"> • M 6020 R red 		
	M 6080 N black		
	<ul style="list-style-type: none"> • M 6050 R red M 6050 N black 		
	<ul style="list-style-type: none"> • M 6055 R red 		

Maintained pushbuttons

	<ul style="list-style-type: none"> • M 6065 R red 	
	<ul style="list-style-type: none"> T 6045 R red 	

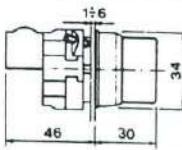
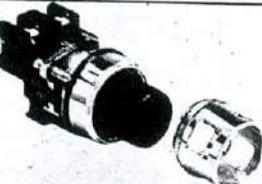
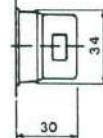
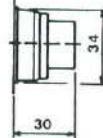
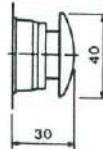
1) When used for emergency purpose, use yellow legend plate.

2) Contact blocks to be used:  V40 - F40  VA0 - FA0 max. 4 contacts.

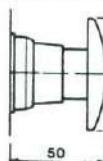
● Normally stocked items

Ø 30 - Round series

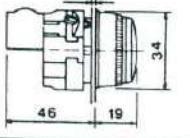
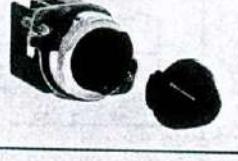
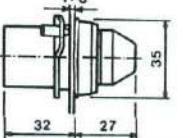
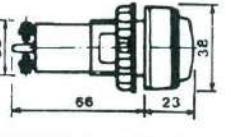
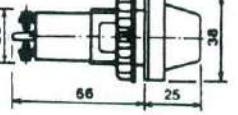
Illuminated momentary pushbuttons

	Operator part no.	Colour of actuator	
	• M 6122 R 406 • M 6122 V 406 • M 6122 G 406 • M 6122 A 406 • M 6122 B 406	red green yellow blue white	
	• M 6122 R 406 • M 6122 V 406 • M 6122 G 406 • M 6122 A 406 • M 6122 B 406	red green yellow blue white	+ metal guard P 19255 
	• M 6120 R 406	red	
	M 6150 R 406	red	

Illuminated maintained pushbutton

	T 6145 R 406	red	
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Pilot lights

	• M6631	lens to be ordered separately	red green yellow blue white	G 2842 R G 2842 V G 2842 G G 2842 A G 2842 B	
	T6632	lens to be ordered separately	red green yellow blue white	G 2843 R G 2843 V G 2843 G G 2843 A G 2843 B	
	• S30E14	lenses to be ordered separately	red green yellow blue white	G 2841 R G 2841 V G 2841 G G 2841 A G 2841 B	
			red green yellow blue white	P 21491 R P 21491 V P 21491 G P 21491 A P 21491 B	

1) Ex M 6121 X 406.

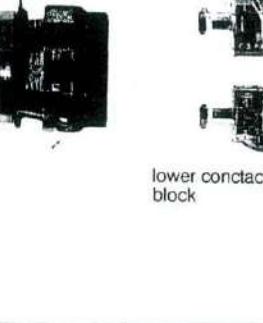
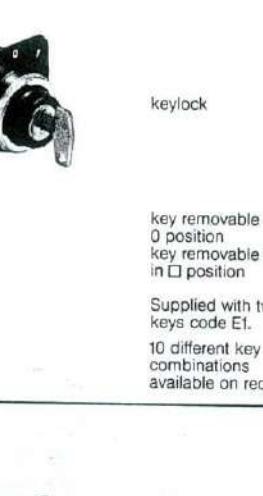
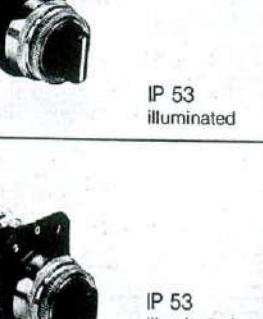
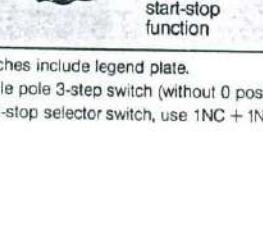
2) Contact blocks to be used:  V40 - F40  VA0 - FA0 max. 2 contacts.

● Normally stocked items

Ø 30 - Round series

Non-illuminated and illuminated selector switches

10

		Contact closure sequence										
		0	1	2	0	1	2	0	1	2	0	1
	upper contact block	V40 - F40 1 NC		X		X		X		X	X	
		V50 - F50 1 NO			X			X		X	X	
		VR0 - FR0 1 NC		X		X	X		X	X		X
		V40 - FA0 1 NC			X		X	X		X	X	X
	lower contact block	V40 - F40 1 NC			X							X
		V50 - F50 1 NO				X			X			X
		VR0 - FR0 1 NC		X		X	X		X	X		X
		V40 - FA0 1 NC			X		X	X		X		X
	keylock	0	1									
		0		1								
		0	←	1								
		0			1							
		0				M 6205 N						
		2	0	1								
		2	0	1								
		2	→	0	←	1						
	black long handle	0	1									
		0	←	1								
		0		1								
		0			1							
		2	0	1								
		2	0	←	1							
		2	→	0	←	1						
		2	→	0	←	1						
	IP 53 illuminated 4)	0	1									
		2	0	1								
		2	0	1								
		2	→	0	←	1						
	IP 53 illuminated start-stop function 5)	2	→	0	←	1						
		2	→	0	←	1						
		2	→	0	←	1						
		2	→	0	←	1						

1) All selector switches include legend plate.

2) To obtain a single pole 3-step switch (without 0 position), use 2NC + 1NO
 3) To obtain a start-stop selector switch, use 1NC + 1NO

4) Colours available: red (R), green (V), yellow (G), blue (A), white (B).
To order replace X with letter in brackets.

5) Supplied with V40 + V50 contact blocks.

3) Supplied with V40 + V50 contact blocks.

- Normally stocked items

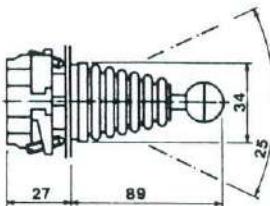
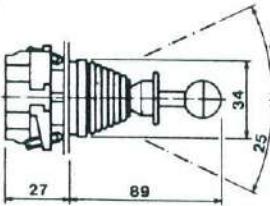
Ø 30 - Round series

Joy stick operators

1)

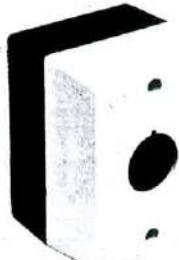
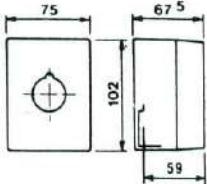
		Contact closure sequence						
		2	0	1	3	2	0	1
upper contact block	V40 - F40 1 NC			X				X
	V50 - F50 1 NO	X				X		
	V40 - FA0 1 NC	X	X		X	X	X	X
lower contact block	V40 - F40 1 NC		X			X		
	V50 - F50 1 NO			X				X
	V40 - FA0 1 NC		X	X		X	X	X
no latch	2 0 1				M 6530 NM			
	2 → 0 ← 1				M 6531 NM			
	3 2 0 1 4					M 6550 NM		
	3 2 → 0 ← 1 4					M 6551 NM		
with mechanical latch in "0" position	2 0 1				M 6570 NM			
	2 → 0 ← 1				M 6571 NM			
	3 2 0 1 4					M 6580 NM		
	3 2 → 0 ← 1 4					M 6581 NM		



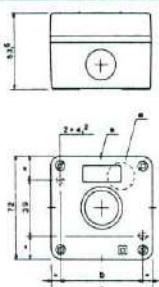



1) All joy stick operators include legend plate.

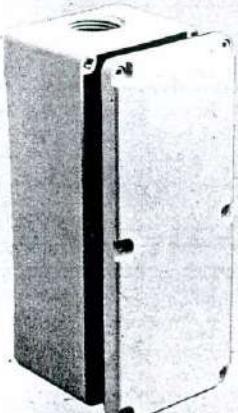
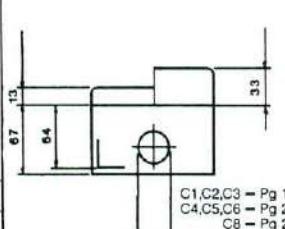
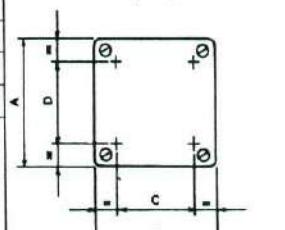
Ø 30 - Enclosures without control units

	IP	No.of holes	grey cover	yellow cover	
	54	1	CT 7030	CT 7031	

thermoplastic material 1)

	IP	No.of holes	grey cover		
	65	1	* PT30 - 1H	72 59	

thermoplastic material 1) 3)

	IP	cover with knockouts at hole locations No.of holes	cover without holes low	high	boxes	dimensions A B C D	
	65	1 * P 1B - 0130 2 P 2B - 0230 3 P 3B - 0330	P 1B P 2B P 3B P 4B P 5B P 6A P 8A	C1 C2 C3 C4 C5 C6 C8	91 91 71 46 151 91 71 106 204 91 71 159 256 91 71 211 360 91 71 315 204 169 149 159 290 257 237 245	 C1,C2,C3 - Pg 16 C4,C5,C6 - Pg 21 C8 - Pg 29	

sealed fiberglass polyester resin 2)

1) Boxes with knockouts for Pg 13.5 cable gland (part no. G 2519)

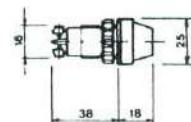
2) Self-extinguishing, withstands shocks and chemical agents

3) For base mounting of contact blocks, pls order also mounting cover plate P 25461.

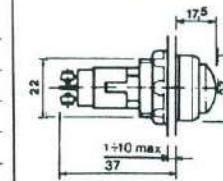
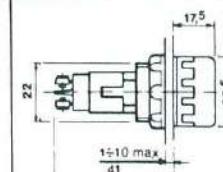
● Normally stocked items

Ø 16-22 Monolithic pilot lights

Pilot lights		∅	Part. no.	Colour	Lens
	thermoplastic lens IP 65	BA9s	* S16BA9S	red green yellow blue white	P 21493 R P 21493 V P 21493 G P 21493 A P 21493 B
	thermoplastic lens IP 65	16	lenses to be ordered separately	red green yellow blue white	P 20827 R P 20827 V P 20827 G P 20827 A P 20827 B

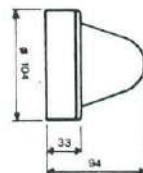


Pilot lights		Part no.	Colour	Lens	
	BA9s monolithic pilot 250V max 3W	* SR 601	lens to be ordered separately	red green yellow blue orange transparent	P 22821 R P 22821 V P 22821 G P 22821 A P 22821 L P 22821 T
	E10 monolithic pilot BA9s with chromed ring IP 53 250V max 2W	* SR 602 S22BA9S * S22E10	lens to be ordered separately	red green yellow blue white	G 2839 R G 2839 V G 2839 G G 2839 A G 2839 B



1) All joy stick operators include legend plate.

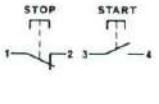
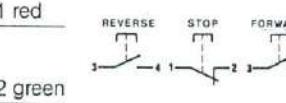
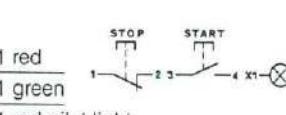
● Normally stocked items

Jumbo pilot light		Part no.	Colour	Dimensions
	E14 250V 12W max ¹⁾ IP 67	* 5410 R 5410 V 5410 G	red green yellow	

1) Accepts L90 - L91 flashers.

● Normally stocked items

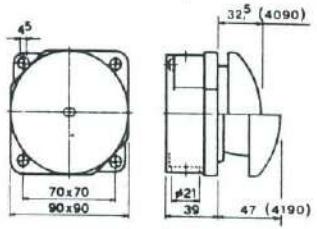
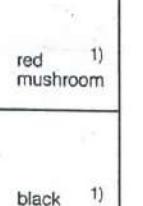
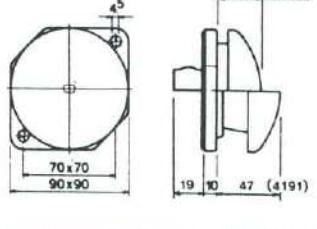
Double insulation control stations

	IP	Code of actuator	Colour of actuator	Diagram and legend plate	Dimensions
 <p>Wobble mushroom</p>  <p>Mushroom head turn to reset</p> <p>0 - 1 a 60° key removable in "0" position</p>	65	• PT81V	green		a 72 b 59 c 11,5
		• PT81R	red		
		• PT85R	red		a 72 b 59 c 28
		• PT65R	red		
		• PT200N	black		a 72 b 59 c 29
		• PT82	1 red 1 green		a 105 b 92 c 11,5
		• PT83	1 red 2 green		a 138 b 125 c 11,5
		• PT87	1 red 1 green 1 red pilot light		a 138 b 125 c 17,5

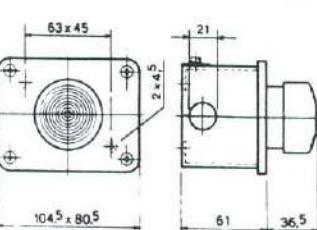
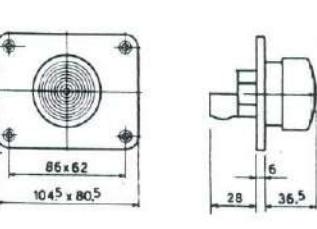
1) No. 4 knockouts for Pg 13,5 cable glands
 2) Ø 19 knockouts. No. 1 for PT 81-82-200-85-65
 No. 2 for PT 83-87

● Normally stocked items

Thermoplastic control stations 10A 380V~

	IP	Momentary push mushroom	Wobble mushroom	Diagram
 red 1) mushroom		• 4090 R	• 4190 R	 32.5 (4090) 45 70x70 90x90 21 39 47 (4190)
 black 1) mushroom	65	4090 N		
 flush mounting		4091 R	4191 R	 32.5 (4091) 45 70x70 90x90 19 10 47 (4191)

Metal control stations 10A 380V~

	IP	Momentary push mushroom	Diagram
 red 2) mushroom		• 5090 R	 63x45 21 104.5 x 80.5 2x4.5 61 36.5
 flush mounting	65	• 5091 R	 86x62 104.5 x 80.5 6 28 36.5

1) Boxes with knockouts for Pg 13,5 cable glands (part no. G 2519)
or Ø 21 grommets (part no. P 9695)

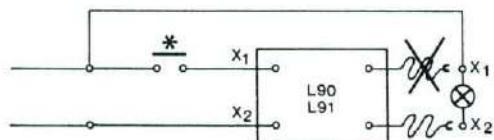
2) Supplied with grommets and suitable for Pg 13,5 cable glands (part no. G 2519)

● Normally
stocked items

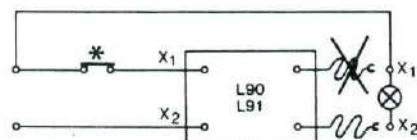
Power supplies

	Approvals	Part. no.	Voltage	Lamps to be used
transformers		* 5 B0	110/6V	
		* 5 70	220/6V	
		* 4 B0	110/24V	
		* 4 70	220/24V	
		* 4 G0	380/24V	
resistors	RESISTOR FOR AC END DC	* R S0	110/48V	48V - 1,2W
	RESISTOR WITH DIODE FOR AC ONLY	RD1	110/48V	48V - 1,2W
	RESISTOR WITH DIODE FOR AC ONLY	RD2	220/130V	130V - 2,6W
flashers		* L 90	24V - 2-12W AC - DC	
		* L 91	110-130V - 2-12W AC Electronic	

Connections for L 90 - L 91 flashers in case of circuit failure:



Continuous light



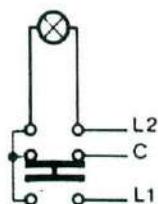
Flashing light

* auxiliary contact

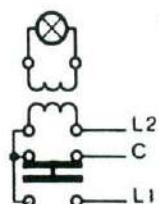
Normally stocked items

TEST PUSHBUTTONS:

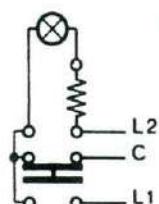
Connection diagrams: grey marked connections are to be made in relation to the various types of power supplies



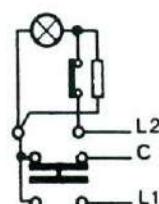
Direct supply



Transformer



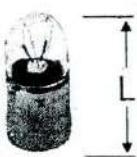
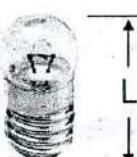
Resistor



Flasher

Accessories

Lamps

	Part no.	Part no.
	BA9s filament (L=23) 6V - 1 ÷ 1,2W P 14591/15 24V - 2 W P 14591/6 48V - 1,2W P 14591/7 130V - 2 W P 14591/14	BA7s filament (L=20) 6V - 0,6W P 15994/1 24V - 1,5W P 15994/3 48V - 1,2W P 15994/7
bayonet lamp	BA9s neon (L=28) 220V P 14591/13	
	E10 filament (L=28) 24V - 3W P 11066/1	E10 neon (L=28) 220V P 11066/9
	BA9s - E10 P 21734	

Buttons and lenses with ISO symbols¹⁾

SYMBOLS	BUTTONS		INTERNAL LENSES	
	RM 010 - RT 010	—	RM 120	SR 601
O	P 24200 R	—	P 24230	P 24245
I	P 24201 N	P 24201 V	P 24231	P 24246
II	P 24202 N	P 24202 V	P 24232	P 24247
→	P 24203 N	P 24203 V	P 24233	P 24248
STOP	P 24204 R	—	P 24234	P 24249
START	P 24205 N	P 24205 V	P 24235	P 24250
ARRESTO	P 24206 R	—	P 24236	P 24251
MARCIA	P 24207 N	P 24207 V	P 24237	P 24252
Ø 22 round series				
SYMBOLS	BUTTONS		INTERNAL LENSES	
	QM 010 - QT 010	—	QM 120	QM 122
O	P 24215R	—	P 24784	P 24769
I	P 24216 N	P 24216 V	P 24785	P 24770
II	P 24217 N	P 24217 V	P 24786	P 24771
→	P 24218 N	P 24218 V	P 24787	P 24772
STOP	P 24219 R	—	P 24788	P 24773
START	P 24220 N	P 24220 V	P 24789	P 24774
ARRESTO	P 24221 R	—	P 24790	P 24775
MARCIA	P 24222 N	P 24222 V	P 24791	P 24776
Ø 22 square series				P 24267

1) R - red V - green N - black

Accessories

		Part no.
	6,35 mm slip-on terminal for screw terminal connection	1417
	6,35 mm double slip-on terminal for F40-F50-FA0-FR0 contact blocks	1418
	terminal protection IP 20 for screw terminal contact blocks V40 V50 VR0 VA0 for direct supply P 24417 R P 24418 V P 24419 H P 24420 G P 24854 N	
	dust-tight cover plates for one contact block P 15973 for two contact blocks P 18096 base mounting plate for contact blocks P 25461	P 15973 P 18096 P 25461
	seal caps IP 66 for RM/RT 010 red black green transparent for M 6010 X red black green transparent for QM/QT 010 transparent	P 17482 R P 17482 N P 17482 V P 17482 T P 17483 R P 17483 N P 17483 V P 17483 T P 24280
	panel hole adapter from 30 mm dia. into 22,5 mm dia. for round series RM/RT	G 2326
	for square series QM/QT	G 2327
	washer to reinforce thin panels for Ø 22 for Ø 30 P 18822 P 18823	
	key normally supplied with selector switches	E1

	Part. no.
	Earthing cover plate G 2621
	Terminals seal cap for pilot lights SR 601 and SR 602 P 25010
	Base mount plate metal non-illuminated operators only Ø 22 1415
	Direct power supply for enclosure G 2134
	* Screw terminal contact blocks for terminal mounting on back panel 1NC 1NO G 1769 G 1770
	late break 1NC G 2645
	early make 1NO G 2646
	Threaded caps Pg 16 Pg 21 Pg 29 Pg 36 P 23088 P 23286 P 23287 P 24863
	Caps to cover unused holes for Ø 22 holes for Ø 30 holes G 1299 G 1300
	Grommet for Ø 21 hole P 9695
	Cable glands Pg 13,5 Pg 16 Pg 21 Pg 29 Pg 36 G 2519 G 2456 G 2457 G 2458 G 2459
Aluminium selfadhesive plates for PT control stations.	
Blank	P 25464
Start	P 25465
Stop	P 25466
Reverse	P 25470
Avanti	P 25467
Indietro	P 25468
0 - 1	P 25481
Forward	P 25469

Accessories

Legend plates for pushbuttons		
	Ø 22	Ø 30
thermoplastic		
black background		
MARCA	P 22905	P 13061
ARRESTO	P 22906	P 13062
AVANTI	P 22907	P 13063
INDIETRO	P 22908	P 13064
SALITA	P 22909	P 13065
DISCESA	P 22910	P 13066
SINISTRA	P 22911	P 13068
DESTRA	P 22912	P 13069
CHIUDE	P 22913	P 13070
APRE	P 22914	P 13071
INSERITO	P 22915	P 13078
DISINSERITO	P 22916	
LENTO	P 22917	P 13084
RAPIDO	P 22918	P 13085
MANUALE	P 22919	
AUTOMATICO	P 22920	P 15413
AUMENTA	P 24286	P 13076
DIMINUISCE	P 24287	P 13077
ACCESO	P 24445	
SPENTO	P 24446	
OPEN	P 22929	
CLOSED	P 22930	
CLOSE	P 24526	
ON	P 22931	
OFF	P 22932	P 17997
IN	P 22933	
OUT	P 22934	
UP	P 22935	
DOWN	P 22936	
FAST	P 22937	
SLOW	P 22938	
INCH	P 22939	
RUN	P 22940	
FORWARD	P 22941	
REVERSE	P 22942	
START	P 24520	
STOP	P 24521	P 13087
red background		P 13088
STOP	P 22948	
ARRESTO	P 22949	
EMERGENZA	P 22950	
90 mm dia. Self adhesive legend plate yellow background		
ARRESTO EMERGENZA	P 24006	
EMERGENCY STOP	P 24007	
BLANK	P 24005	

Legend plates for selector switches			
	Ø 22	Ø 30	
thermoplastic black background			
0	1		
2	0	P 22921	
0	1	P 22922	
AUTO	MAN	P 22923	
ARR.	MARCA	P 22924	
APRE	CHIUDE	P 22925	
1	2	P 22926	
OPEN	OFF	CLOSED	P 22988
AUTO	0	MAN	P 22927
AVAN.	0	INDIET.	P 22928
OFF	ON		P 22976
1	0	2	P 24447
0	MAN		P 24720
0	1	2	P 24721
1	2		P 24804
INS	DIS		P 24805
ON	OFF	AUTO	P 24711
			P 25763
Blank legend plates			
in aluminium to be engraved			
black background			
	P 24143	P 13086	
in aluminium to be engraved			
black background			
	P 24802		
in aluminium to be engraved with black thermoplastic legend plate bearer			
black background			
	G 2382		
in thermoplastic to be marked - up			
black background red background			
	P 22850 P 22851	P 18007	
in thermoplastic			
black background			
	P 24907 to be engraved	P 20892 to be marked-up	
EMERGENCY STOP	P 25692		
yellow background			
in thermoplastic to be marked up	P 25691 G	P 21186	

D



APEX ELECTRICAL LTD.

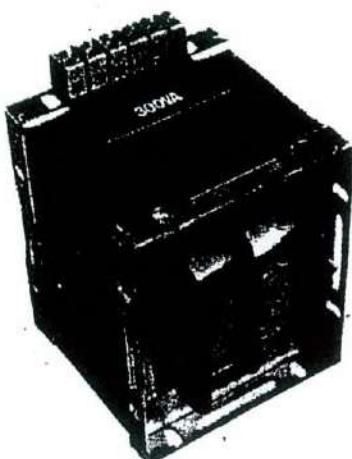
32 GARDEN LANE, (off Francis St.,) DUBLIN 8.

Phone: 541066/ 541135 Fax: 544347

Mobile Phone: 088/ 556688

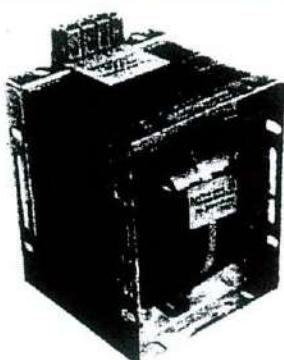
THE RAMPARTS, DUNDALK.

Phone: 042-34916/ 31945 Fax: 042-31012



A Range of Control Transformers designed to B.S. 3535. Having Primary Voltages of 0-240 or 0-415 Secondary Voltage 0-110V/55-0-55/0-24. Other Input/Output Voltages and Multi Taps are also available on request.

See our Standard Price List for Complete Range



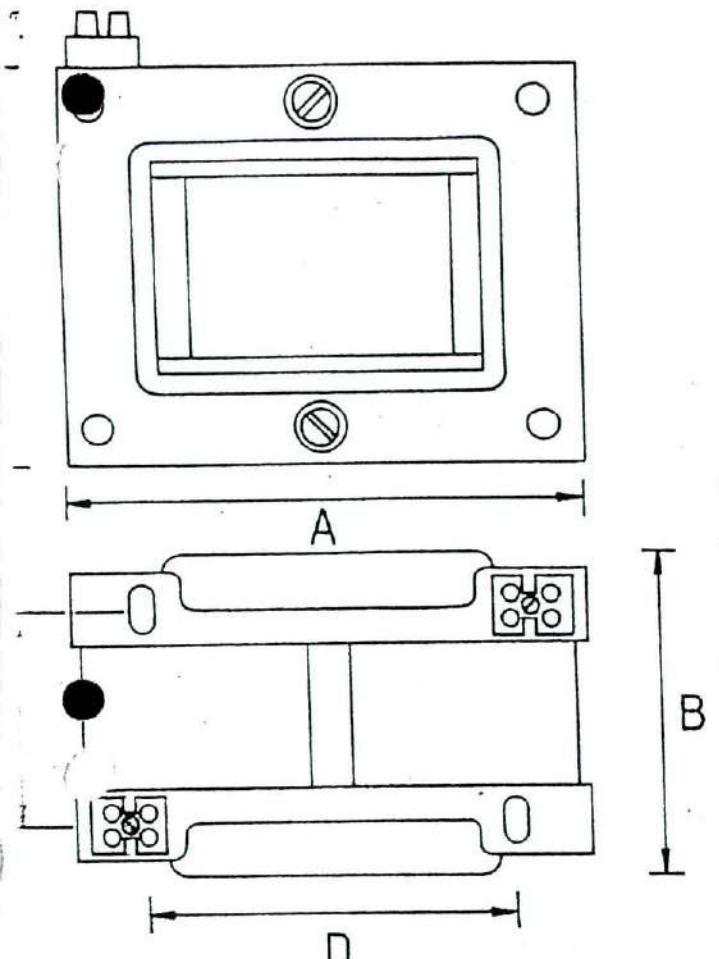
Insulating Materials Used are to the Highest standards. Minimum Class (F) in most cases Class (H) The Core Being Impregnated in Varnish to B.S. 2778 Standard H.V Flash Test 2xworking Voltage Plus 1,000 Volts A.C.

Where Panels are fitted Tufnol to B.S. 2572 of a suitable Thickness to ensure good mechanical strength is used. Smaller Transformers are fitted with Klippon T/Blocks, larger types are stud Terminals.

Wall/Floor Mounting Enclosures are available to suit most Transformers.

We specialise in the Manufacture of Transformers, including Auto-wound and 3 Phase, one offs or Production runs.

Should Your Requirements Fall outside our standard Range, we would be pleased to design and build to your requirements.



STYLE B
Terminal Block Connections from 50va

I.A.	A	B	C	E	D	Kg.
100	100	100	100	65	65	3
120	120	120	120	65	80	5.5
500	120	165	150	68	89	7
1000	150	180	180	105	100	13.7
2000	190	210	230	115	125	23
3000	190	210	230	115	125	25
4000	230	260	300	140	165	38
5000	230	260	300	140	165	39.5
6000	230	260	300	140	165	41
10	270	270	350	195	200	85

A - Length

B - Width

DIMENSIONS IN MILLIMETRES

C - Height

D - Hole centres

OPEN TYPE TRANSFORMERS



APEX ELECTRICAL LTD.

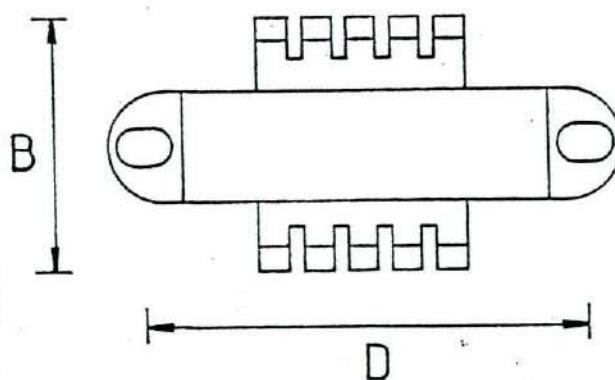
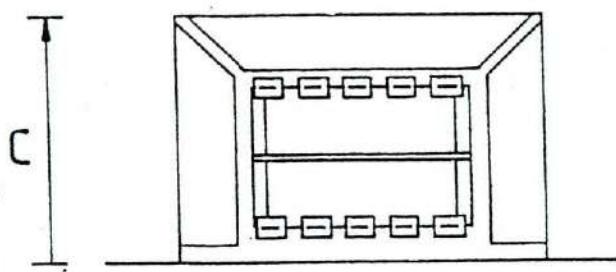
32 GARDEN LANE, (off Francis St.,) DUBLIN 8.

Phone: 541066/ 541135 Fax: 544347

Mobile Phone: 088/ 556688

THE RAMPARTS, DUNDALK.

Phone: 042-34916/ 31945 Fax: 042-31012



STYLE A 5va to 30va
Terminations to solder tags on Bobbin

VA	SIZE	A	B	C	D	E	PRICE
5	9/16 x 18	66.6	31.7	38.1	53.9	—	3.25
10	3/4 x 35	88.9	50.8	50.8	76.2	—	5.23
20	1 x 29	107	60.3	63.5	92	—	6.11
30	1 x 29	107	60.3	63.5	92	—	7.00

DIMENSIONS IN MILLIMETRES

E



Betriebsanleitung

Operating instruction

Die Drehstrom-Unterspannungsrelais AA 9943 und BA 9043 überwachen den Spannungsbetrag zwischen den 3 Phasen und dem Nulleiter. Bei den Geräteausführungen AA 9943.--/001 und BA 9043.--/001 ist L 3 die Referenzphase, gegen welche die anderen 2 Phasen überwacht werden.

Funktion

Mit Hilfe des oberen Einstellknopfes kann auf der zugeordneten Prozentualskala „U_{an} (%)“ (-15 bis +5% der Nennspannung) der Ansprechwert U_{an} des Ausgangsrelais eingestellt werden. Der Rückfallwert U_{ab} des Ausgangsrelais wird mit dem unteren Einstellknopf an der zugeordneten Skala „U_{ab} (xU_{an})“ im Bereich von 0,75 - 0,95 des Ansprechwertes eingestellt. Das heißt: Bei Verstellen des Ansprechwertes wird automatisch der Absolutwert des Rückfallwertes verstellt, wohingegen eine Verstellung des Rückfallwertes lediglich eine Verschiebung des relativen Rückfallwertes zur Folge hat; der Absolutwert des Ansprechwertes bleibt erhalten. Bei den Drehstrom-Unterspannungsrelais AA 9943 und BA 9043 wird das Ausgangsrelais nur erregt, wenn alle 3 Phasenspannungen über dem eingestellten Ansprechwert liegen. Sinkt jedoch nur 1 Phase unter den eingestellten Rückfallwert, so wird das Ausgangsrelais entriegelt.

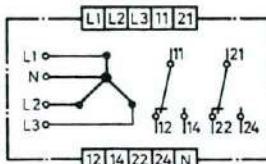


Bild 1 Schaltbild AA 9943, BA 9043, BA 9043/002

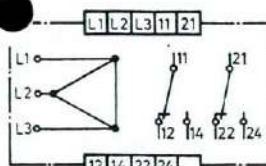


Bild 2 Schaltbild AA 9943/001, BA 9043/001, BA 9043/003

Beispiel

Gegeben sei ein Dreiphasennetz 220/380 V 50 Hz und ein AA 9943 oder BA 9043 220/380 V 50 Hz Nennspannung. Das Unterspannungsrelais soll eine Unterspannungsmeldung geben, wenn mindestens 1 der 3 Phasen unter 180 V absinkt, wobei die Anlage erst freigegeben werden soll, wenn alle 3 Phasen mindestens 209 V führen.

1. Einstellung des Ansprechwertes U_{an} an der oberen Skala

$$U_{an} = \frac{\text{Ansprechwert} - \text{Nennspannung}}{\text{Nennspannung}} \% = \frac{209 - 220}{220} \% = -5\%$$

2. Einstellung des Rückfallwertes U_{ab} = 180 V an der unteren Skala: Hierbei ist zu beachten, daß mit dem eingestellten Ansprechwert gerechnet werden muß:

$$U_{ab} = \frac{\text{Rückfallwert} - \text{Ansprechwert}}{\text{Ansprechwert}} = \frac{180 - 209}{209} = 0,86$$

The three-phase under voltage relays AA 9943 and BA 9043 monitor the voltage between the three phases and the neutral conductor. At the designs AA 9943.--/001 and BA 9043.--/001 the terminal L 3 is the reference for the measurement of the other 2 phases.

Function

The response value U_{on} of the output relay is set by means of the upper setting knob against the percentage scale „U_{on} (%)“ (-15 to +5% of the nominal voltage). The release value U_{off} for the output relay is set with the lower button against the scale within the range of 0,75 - 0,95 of the response value. This means to say that the absolute value of the release value is automatically adjusted when setting the response value while – on the contrary – an adjustment to the release value only alters the relative value of the release; the absolute figure for the response value remains unaltered.

On both three-phase under voltage relays AA 9943 and BA 9043 the output relay is only energized when all three phase voltages are in excess of the response value. If, however, only 1 phase drops below the set release value, the output relay is de-energized.

Example

There is a three-phase mains 220/380 V 50 Hz and AA 9943 or BA 9043 for a nominal voltage of 220/380 V 50 Hz.

The under voltage relay should transmit an undervoltage signal if at least one of the three phases drops below the 180 V, whereby the plant is only to be released when at least 209 V are on all three phases.

1. Setting of the response value U_{on} on the upper scale

$$U_{on} = \frac{\text{Response value} - \text{nominal voltage}}{\text{nominal value}} \% = \frac{209 - 220}{220} \% = -5\%$$

2. Setting of the release value U_{off} = 180 V on the lower scale: Hereby it must be considered that the calculation has to be made by the set response value:

$$U_{off} = \frac{\text{Release value}}{\text{Response value}} = \frac{180}{209} = 0,86$$

Technische Daten

Ansprechspannung U_{an} :	0,85–1,05 U_N stufenlos mit oberem Drehknopf einstellbar (Nominalspannung U_N siehe Typenschild)
Rückfallspannung U_{ab} :	0,75–0,95 U_{an} stufenlos mit unterem Drehknopf einstellbar
Einstellgenauigkeit:	± 5 %
Temperaturbereich:	– 20 ... + 60 °C
Temperatureinfluß:	≤ 0,05 %/°C
Überlastbarkeit:	1,2 U_N dauernd
Kontaktbestückung:	AA 9943.11 1 Wechsler AA 9943.12 2 Wechsler BA 9043.12 2 Wechsler
Kontaktart:	Federkontakte
Schaltverzögerung t_M :	Bei schnellen Spannungsänderungen am Meßeingang kann sich der neue arithmetische Mittelwert erst nach einer kurzen Verzögerungszeit einstellen. Das Diagramm (Bild 3) zeigt die Verzögerung in Abhängigkeit von den Meßgrößen X_{an} – X_{ab} bei plötzlichem An- oder Abschalten. Bei langsamer Änderung der Meßgeräte verringert sich die Verzögerungszeit.

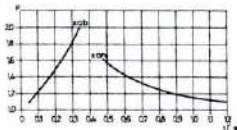


Bild 3 Diagramm

Beispiel:	U eingestellt = 190 V $F = \frac{240 \text{ V}}{190 \text{ V}} = 1,26$ U angelegt = 240 V ergibt aus Diagramm t_M an = ca. 800 ms t_M ab = ca. 100 ms
Zeitverzögerung t_V :	stufenlos einstellbar von 0,5–10 s bei BA 9043/002, BA 9043/003 Sinkt eine oder mehrere Phasenspannungen um mehr als 0,6 U_N ab, fällt das Ausgangsrelais nach Diagramm ab.

Schaltvermögen der Kontakte:	
AC 11	110 V~ 220 V~ VDE 0660 T 200 4 A 3 A
DC 11	24 V~ 60 V~ 110 V~ 220 V~ 2 A 0,8 A 0,4 A 0,2 A
Kontaktlebensdauer:	bei 100 % des Schaltvermögens $> 0,1 \times 10^6$ Schaltungen bei Kontaktbelastung 220 V~, 0,2 A $> 10 \times 10^4$ Schaltungen
Einbauriegel:	beliebig
Leiteranschluß:	2 x 2,5 mm ² massiv oder 2 x 1,5 mm ² Litze mit Hülse
Befestigungsmaß:	30 x 50 mm (M4) und 35 x 60 mm (M5) nach DIN 43604
Schnellbefestigung:	Hutschiene DIN EN 50 022-35
Wartung:	Eine besondere Wartung ist nicht notwendig. Die Geräte kommen geprüft und anschlußfertig zum Versand.

Technical Data

Response voltage U_{on} :	0,85–1,05 U_N infinitely variable setting by upper setting knob (Nominal voltage U_N see type plate)
Release voltage U_{off} :	0,75–0,95 U_{on} infinitely variable setting by means of the lower setting knob
Setting accuracy:	± 5 %
Temperature range:	– 20 ... + 60 °C
Temperature influence:	≤ 0,05 %/°C
Overload capacity:	1,2 U_x x nominal voltage continuously
Contacts:	AA 9943.11 1 change-over AA 9943.12 2 change-overs BA 9043.12 2 change-overs
Type of contacts:	Spring contacts
Switching delay t_M :	For quick voltage changes in measuring input the new arithmetic mean value can adapt itself but after a short delay time. The diagram (figure 3) shows the delay in relation to values X_{an} – X_{ab} following abrupt switching on and off. The delay period is reduced when the measuring value is slowly reduced.

Example:

Voltage U set = 190 V $F = \frac{240 \text{ V}}{190 \text{ V}} = 1,26$
Voltage U applied = 240 V
brings according to diagram
t_M on = approx. 800 ms
t_M off = approx. 100 ms
infinitely variable setting of 0,5–10 s by BA 9043/002, BA 9043/003
Drop one or several phase voltages by more than 0,6 U_N and deenergize the relay output according to the diagram.

Nominal breaking capacity (contacts):

AC 11	110 V a.c. 220 V a.c. VDE 0660 T 200 4 A 3 A
DC 11	24 V d.c. 60 V d.c. 110 V d.c. 220 V d.c. 2 A 0,8 A 0,4 A 0,2 A

Life expectancy, contacts:

At 100 % of rated capacity $> 0,1 \times 10^6$ operations
At contact load 220 V a.c., 0,2 A $> 10 \times 10^4$ operations

Mounting position:

As required

Electrical connections:

2 x 2,5 mm² solid or 2 x 1,5 mm² leads with sheath

Mounting measurements:

30 x 50 mm (M4) and 35 x 60 mm (M5) to DIN 43604

Fast mounting:

Mounting on DIN rail EN 50 022-35

Maintenance:

No special maintenance is necessary. The instruments are dispatched and ready for connection.

E. DOLD & SÖHNE KG – RELAISFABRIK

D-78114 Furtwangen · Postf. 60 · Tel. (0 77 23) 65 40 · Telex: 7 92 927 · Telefax (0 77 23) 65 43 56 · Teleg.: Doldsoehne Furtwangen

F

Betriebs- und Montageanleitung

Deutsch

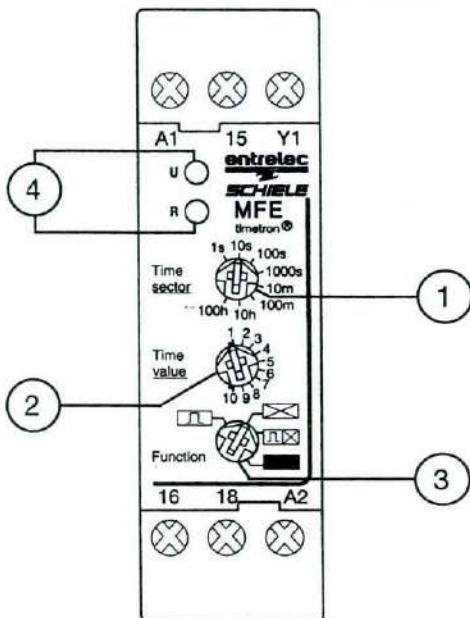
Elektronische Zeitrelais timetron®

Zeitrelais timetron® Economy-Reihe

MFE

Die ENTRELEC-SCHIELE timetron® Economy-Reihe besteht aus Multifunktions- und Singlefunktions-Relais mit den Zeitableäufen ansprechverzögert, rückfallverzögert, einschaltwischend, ausschaltwischend, blinkend, Stern-Dreieck- umschaltend.

Nur von einer Fachkraft zu installieren.



I Frontansicht mit Bedienelement

1 Zeitbereiche - Zeitbereichsendwert

Bereich	Endwert
0,05	- 1 s
0,5	- 10 s
5	- 100 s
50	- 1000 s
0,5	- 10 min
5 min	- 100 min
0,5 h	- 10 h
5 h	- 100 h

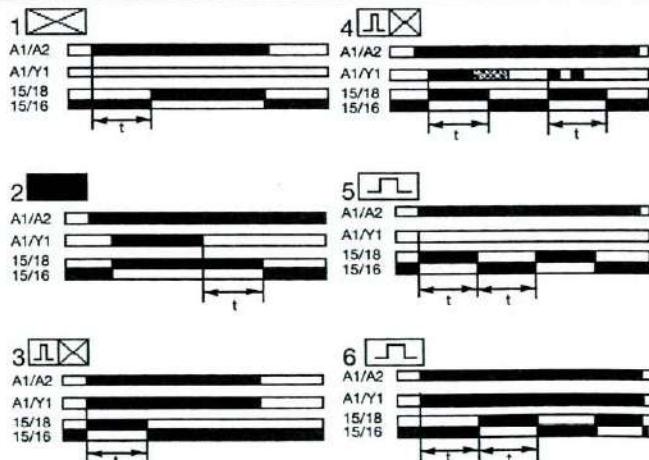
2 Skala zur Einstellung des Zeitwertes innerhalb des gewählten Bereiches

3 Auswahl der Funktion Funktionen siehe II

4 LED Betriebszustandsanzeigen

U	Versorgungsspannung
R	Ausgangsrelais angezogen

Detaillierte technische Daten entnehmen
Sie bitte unserem Katalog !



II Funktionen

1 Ansprechverzögerung

Stellung Ansteuerung über Versorgungsspannung A1

2 Rückfallverzögerung

Stellung Ansteuerung über Steuerkontakt Y1

3 Einschaltwischer

Stellung Ansteuerung über A1, Y1 (gebrückt)

4 Impulsformer

Stellung Ansteuerung über Steuerkontakt Y1

5 Blinker impulsbeginnend

Stellung Ansteuerung über Versorgungsspannung, Steuerkontakt Y1 nicht verbunden

6 Blinker pausebeginnend

Stellung Ansteuerung über A1, Y1 (gebrückt)

t : eingestellte Verzögerungszeit

III Versorgungsspannung

A1 - A2 24...240 V AC/DC 50/60 Hz

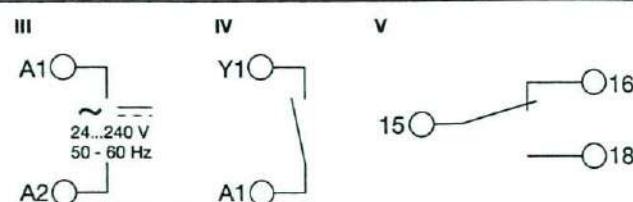
IV Potentialbehafteter Steuereingang

Y1 - A1 Steuerkontakt

V Ausgangsrelais

15/16/18: 4 A / 250 V max.

4 550 021 100



entrelec
schiele

Instruction sheet

English

Electronic timers timetron®

timetron® Economy range

ENTRELEC-SCHIELE timetron® Economy range include multi-function and single-function timers which perform timing functions as follows : delay on operate, delay on release, single puls on operate, single pulse on release, flashing, star-delta transition.

This product should be installed by a technically qualified person.

I Front face with operating elements

1 Timers featuring one timing circuit

Timing ranges - Set to maximum setting

Range	Max. value
0,05	- 1 secs
0,5	- 10 secs
5	- 100 secs
50	- 1000 secs
0,5	- 10 mins
5 mins	- 100 mins
0,5 hrs	- 10 hrs
5 hrs	- 100 hrs

2 Direct reading scale to set time value within chosen range

3 To select the timing mode see II

4 LED status indication

U supply voltage
R output relay

For detailed specifications, see our catalogue.

II Timing modes

1 Delay on operate

Position, Controlled via power supply A1

2 Delay on release

Position, Controlled via control contact Y1

3 Single pulse on operate

Position, Controlled via A1, Y1 (wire linked)

4 Non retrigerable one shot

Position, Controlled via control contact Y1

5 Flasher starting with ON

Position, Controlled via power supply, control contact Y1 not linked

6 Flasher starting with OFF

Position, Controlled via A1, Y1 (wire linked)

t : Set delay time

III Power supply

A1 - A2 24...240 V ac/dc 50/60 Hz

IV Connected control input

Y1 - A1 control contact

V Output relay

15/16/18 4 A / 250 V max

Instructions de service et de montage

Français

Relais électroniques timetron®

Série relais temporisés timetron® Economy

Les séries timetron® de ENTRELEC-SCHIELE se composent de relais multifonction et simple fonction avec temporisation Travail, temporisation Repos, contact de passage à l'excitation, contact de passage à la désexcitation, clignotant, commutation "étoile-triangle".

Ne remettre l'installation qu'entre les mains d'un spécialiste.

I Vues de la partie avant avec éléments de commande

1 Relais avec un circuit temporisé

Plages de temporisation - commutateur de sélection par affichage de la valeur maximum de la plage

Plage	Valeur maximum
0,05	- 1 s
0,5	- 10 s
5	- 100 s
50	- 1000 s
0,5	- 10 min
5 min	- 100 min
0,5 h	- 10 h
5 h	- 100 h

2 Valeur absolue pour le réglage de la temporisation à l'intérieur de la plage réglée.

3 Sélection de la fonction voir II

4 Indications de fonctionnement par LED

U Tension d'alimentation
R Relais de sortie

Veuillez consulter notre catalogue pour obtenir des données techniques plus détaillées.

II Fonctions

1 Temporisation «Travail»

Position, Commande par la tension d'alimentation A1

2 Temporisation «Repos»

Position, Commande par contact de commande Y1

3 Fonction «contact de passage» à l'excitation

Position, Commande par A1, Y1 (ponté)

4 Formateur des impulsions

Position, Commande par contact de commande Y1

5 Fonction clignotant «à la mise sous tension: relais de sortie position «Travail»

Position, Commande par tension d'alimentation, contact de commande Y1 non connecté

6 Fonction clignotant «à la mise sous tension: relais de sortie position «Repos»

Position, Commande par A1, Y1 (ponté)

t : Durée préréglée

III Tensions d'alimentation

A1 - A2 24...240 V ac/dc 50/60 Hz

IV Entrée de commande à potentiel

Y1 - A1 contact de commande

V Relais de sortie

15/16/18 4 A / 250 V max

G

CORTACIRCUITOS FUSIBLES (APR)
COUPE-CIRCUIT A FUSIBLES (HPC)
CARTRIDGE FUSES (HRC)

NH

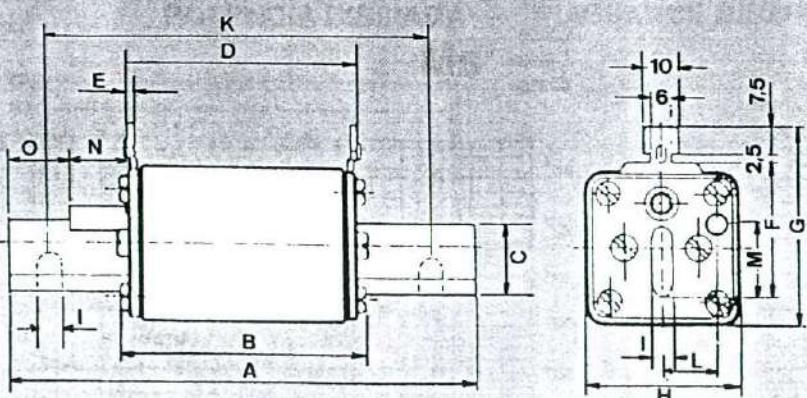
Clase
Classe
Class
gl-gL-gG

TAMAÑO TAILLE SIZE	N.º ART. CON INDICADOR AVEC VOYANT WITH INDICATOR	CON PERCUTOR AVEC PERCUTEUR WITH STRIKER	In (A)	TENSION VOLTAGE (V)	PODER DE CORTE POUVOIR DE COUPE BREAKING CAPACITY (kA)	CAJA/UN. CONDIT/UN. PACKING	Image	
NH - 00	300006 300010 300016 300020 300025 300032 300035 300040 300050 300063 300080 300100 300125 300160		6 10 16 20 25 32 35 40 50 63 80 100 125 160	660	80			300080
NH - 0	301006 301010 301016 301020 301025 301032 301035 301040 301050 301063 301080 301100 301125 301160		6 10 16 20 25 32 35 40 50 63 80 100 125 160	660	80			301160
NH - 1	302050 302063 302080 302100 302125 302160 302200 302250 302315 302355	306080 306100 306125 306160 306200 306250	50 63 80 100 125 160 200 250 315 355	660	80			303400
NH - 2	303100 303125 303160 303200 303250 303315 303355 303400 303425 303500	307125 307160 307200 307250 307315 307355 307400 307425 307500	100 125 160 200 250 315 355 400 425 500	660	80			304630
NH - 3	304315 304355 304400 304425 304500 304630 304800	308315 308355 308400 308425 308500 308630 308800	315 355 400 425 500 630 800	660	80			305100
NH - 4	305500 305630 305800 305100 305125 305160		500 630 800 1000 1250 1600	500	120	1		

Clase
Classe
Class

aM

TAMAÑO TAILLE SIZE	N.º ART. CON INDICADOR AVEC VOYANT WITH INDICATOR	N.º ART. CON PERCUTOR AVEC PERCUTEUR WITH STRIKER	In (A)	TENSION TENSION VOLTAGE (V)	PODER DE CORTE POUVOIR DE COUPURE BREAKING CAPACITY (kA)	CAJA/UN. CONDIT/UN. PACKING	
NH - 00	310010 310016 310020 310025 310032 310035 310040 310050 310063 310080 310100 310125 310160		10 16 20 25 32 35 40 50 63 80 100 125 160	660	80		310020
NH - 0	311035 311040 311050 311063 311080 311100 311125 311160		35 40 50 63 80 100 125 160	660	80	3	311040
NH - 1	312080 312100 312125 312160 312200 312250	316100 316125 316160 316200 316250	80 100 125 160 200 250	660	80		312250
NH - 2	313125 313160 313200 313250 313315 313355 313400	317125 317160 317200 317250 317315 317355 317400	125 160 200 250 315 355 400	660	80	3	313400
NH - 3	314400 314500 314630	318400 318500 318630	400 500 630	660 500	80 120	3	314630



	NH 00	NH 0	NH 1	NH 2	NH 3	NH 4
A	78,5	125	135	150	150	200
B	52	66	70	72	72	84
C	15	15	20	26	34	50
D	49	49	68	68	68	68
E	2	2	2	2	2	2,5
F	35	35	40	48	60	87
G	48	58	64	72	83	117
H	21	27	48	58	68	103
I	6	6	6	6	6	8
J						14
K						150
L						16
M						14,5
N						30
O						15

CORTACIRCUITOS FUSIBLES (APR) COUPE-CIRCUIT A FUSIBLES (HPC) CARTRIDGE FUSES (HRC)

NH

DATOS TECNICOS	DONNEES TECHNIQUES	TECHNICAL DATA
Tensión Nominal U _n	Tension Nominale U _n	Rated Voltage U _n 500V (660V) ~
Intensidad Nominal I _n	Intensité Nominale I _n	Rated Current I _n 6 A - 1250 A
Podér de Corte I _b	Pouvoir de Coupe I _b	Breaking Capacity I _b 120 kA (80 kA)
Características Fusión	Caractéristiques de Fusion	Fusing Characteristics (gI - gL - gG); aM
Aislamiento	Isolation	Insulating class C - VDE 0110
Señalización	Signalisation	Signal Indicador - Percutor
Normas	Normes	Standard publications IEC 269-1, IEC 269-2-1 NFC 63.210-63.211 VDE 0636/21/22 DIN 57.636-43.620 UNE 21.103

APLICACION

Los cartuchos fusibles DF de tipo NH de A.P.R. denominados ocasionalmente de cuchilla, tienen su aplicación en todo tipo de instalaciones, siendo su utilización primordial en las instalaciones industriales y en las distribuciones de uso público y para la protección de líneas, conductores, maquinaria, etc..., utilizando éstos según sus características de fusión.

gI - gL - gG de protección contra: Sobreintensidades y cortocircuitos en líneas y redes de uso generalizado.

aM En la protección de motores contra sobreintensidades, básicamente cortocircuitos, combinados con algún otro elemento de protección.

APPLICATION

Les cartouches fusibles DF de type NH à H.P.C., dénommées occasionnellement à couteaux, sont utilisées pour toutes sortes d'installations et plus particulièrement dans les installations industrielles et les réseaux de distribution publique pour la protection des lignes, câbles conducteurs, machinerie, etc, utilisant ceux-ci selon leurs caractéristiques de fusion.

gI - gL - gG utilisés comme protection contre surintensités, courts-circuits sur lignes et réseaux d'usage général.

aM pour la protection des moteurs contre surintensités, courts-circuits, combinés avec d'autres éléments de protection.

APPLICATION

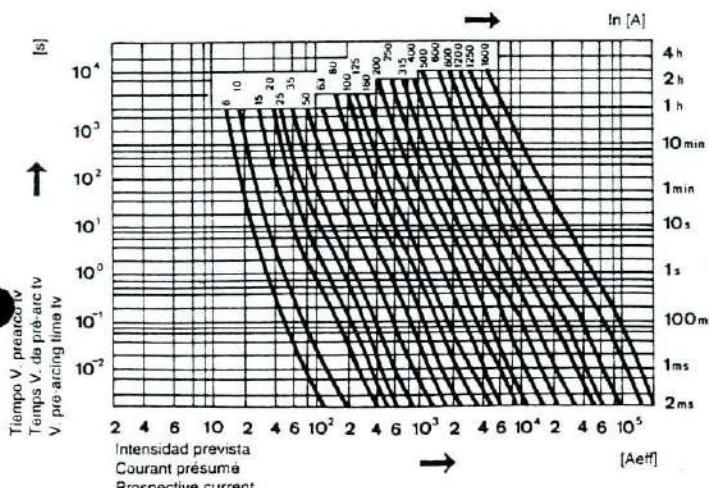
Fuse links DF type NH H.R.C. also called knife fuses, are used in installations, more particularly industrial plants and public distribution networks, to protect electric lines, conductor cables, machinery according to their fusing characteristics.

gI - gL - gG used to protect from overcurrents, short circuits in lines and network installations of general use.

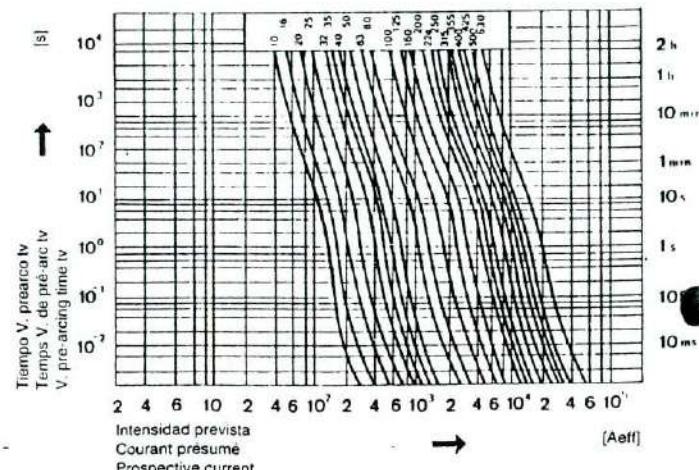
aM for protection of motors from overcurrents, short circuits, combined with other protection elements.

CARACTERISTICAS FUSION t-I • CARACTÉRISTIQUES FUSION t-I • t-I CHARACTERISTICS MELTING

Clase
Classe
Class
gl-gL-gG



Clase
Classe
Class
aM



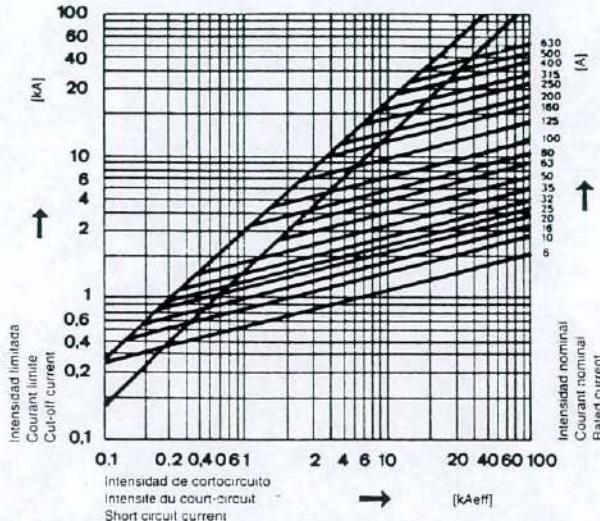
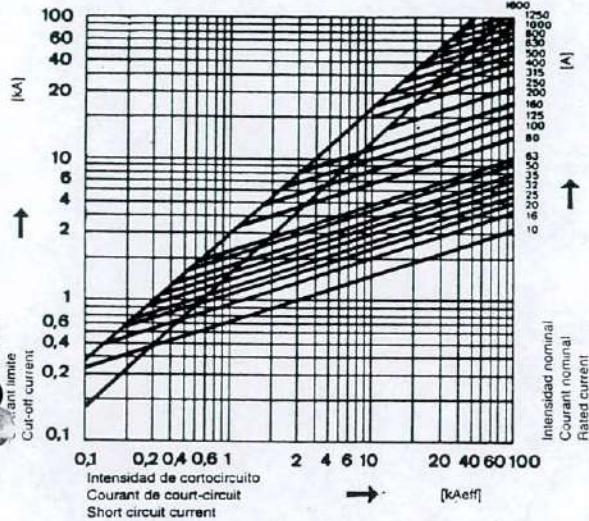
Clase
Classe
Class

gl-gL-gG

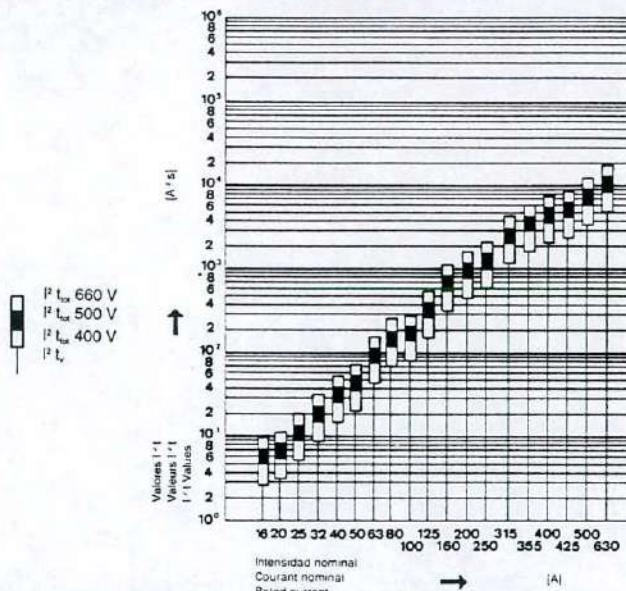
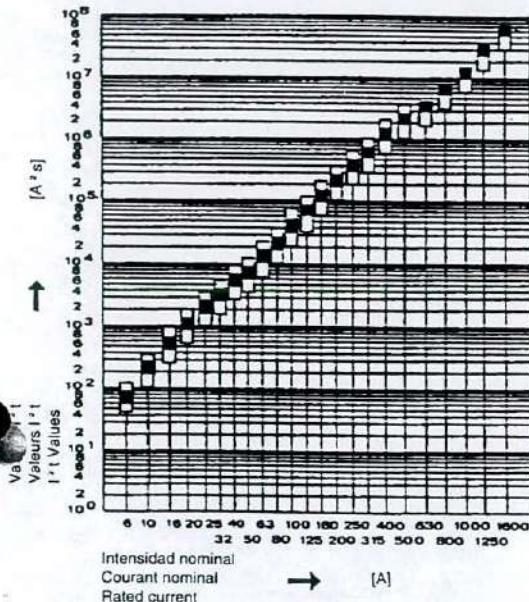
Clase
Classe
Class

aM

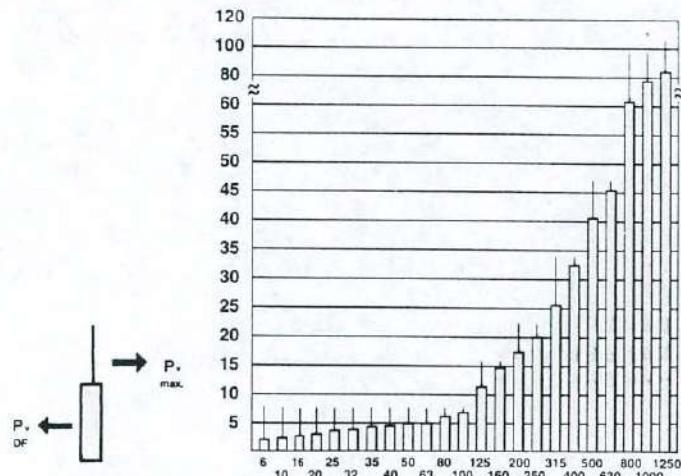
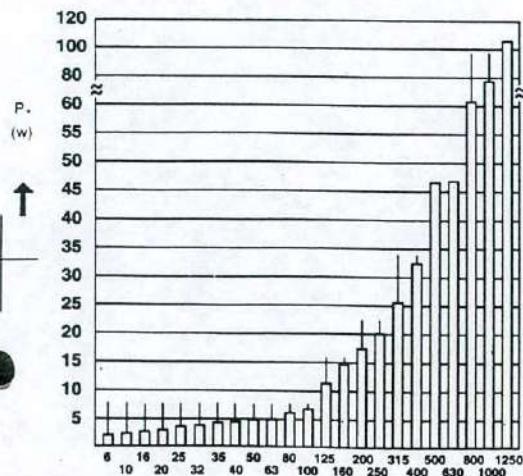
CARACTERISTICAS DE LIMITACION • CARACTERISTIQUES DE LIMITATION • CUT-OFF CHARACTERISTICS



SELECTIVIDAD I^2t • SELECTIVITE I^2t • I^2t SELECTIVITY



POTENCIA DISIPADA • PUissance DISSIPEE • POWER LOSS



**BASES PORTA FUSIBLES
SOCLES PORTE-FUSIBLES
FUSE BASES**

NH

ZOCALO CERAMICO • SOCLE CERAMIQUE • CERAMIC BASE

UNIPOLARES • UNIPOLAIRES • UNIPOLAR

TAMAÑO TAILLE SIZE	N.º ART. ART. NO.	In (A)	CAJA/UN. CONDIT/UN. PACKING
NH 00 I	320100	160	12
NH 0 I	320160	160	6
NH 1 I	320250	250	3
NH 2 I	320400	400	3
NH 3 I	320630	630	3
NH 4 I	320125	1250	1



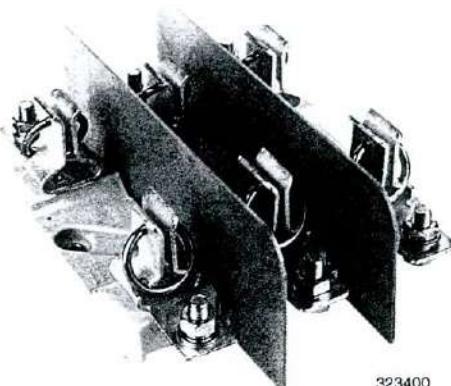
320100



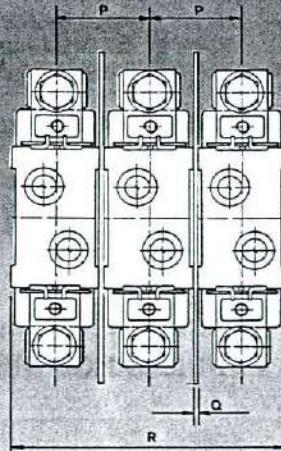
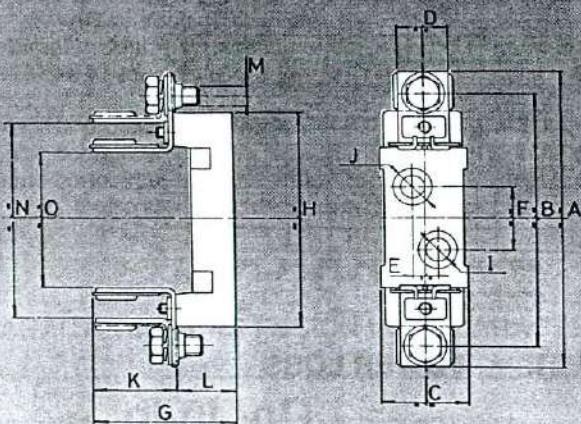
323250

TRIPOLARES • TRIPOLAIRES • TRIPOLAR

NH 00 III	323100	160	3
NH 0 III	323160	160	1
NH 1 III	323250	250	1
NH 2 III	323400	400	1
NH 3 III	323630	630	1



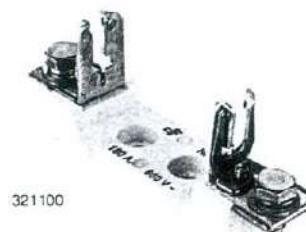
323400



Ref.	NH 00	NH 0	NH 1	NH 2	NH 3	NH 4
A	117	168	204	231	240	310
B	100	150	175	200	214	270
C	34	32	54	54	54	102
D	19	19	27	30	30	50
E	—	—	30	30	30	30
F	25	25	25	25	25	25
G	55	68	68	75	92	145
H	85	120	120	150	150	220
I	8,5	8,5	8,5	10,5	10,5	13
J	14	14	14	22	22	—
K	33	39	39	53	57	—
L	22	29	29	35	35	—
M	8	8	8	12	12	12
N	—	—	—	—	115	—
O	54	74	80	80	80	100
P	34	47	60	68	80	—
Q	2	2	2	2	3	3
R	102	126	175	191	215	—

ZOCALO POLIESTER • SOCLE POLYESTER • POLYESTER BASE
UNIPOLARES • UNIPOLAIRES • UNIPOLAR

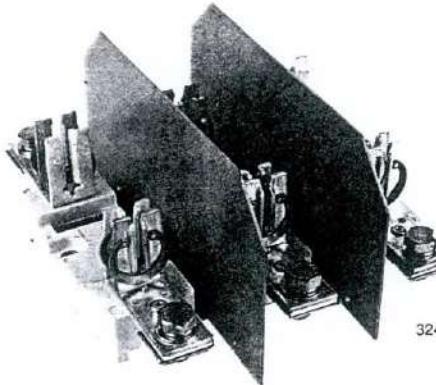
TAMAÑO TAILLE SIZE	N.º ART. ART. N.	In (A)	CAJA/UN. CONDIT/UN. PACKING
NH 00 I	321100	100	12
NH 0 I	321160	160	6
NH 1 I	321250	250	3
NH 2 I	321400	400	3
NH 3 I	321630	630	3



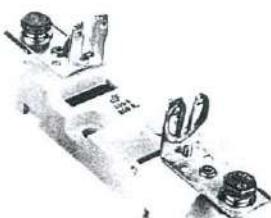
321100

TRIPOLARES • TRIPOLAIRES • TRIPOLAR

NH 00 III	324100	100	3
NH 0 III	324160	160	1
NH 1 III	324250	250	1
NH 2 III	324400	400	1
NH 3 III	324630	630	1



324630



321250

BASES DE NEUTRO SECCIONABLE • BARRETTE DE COUPURE • SECTIONNABLE NEUTRAL BASE

NH 0 I	334160	160	6
NH 1 I	334250	250	3
NH 2 I	334400	400	3



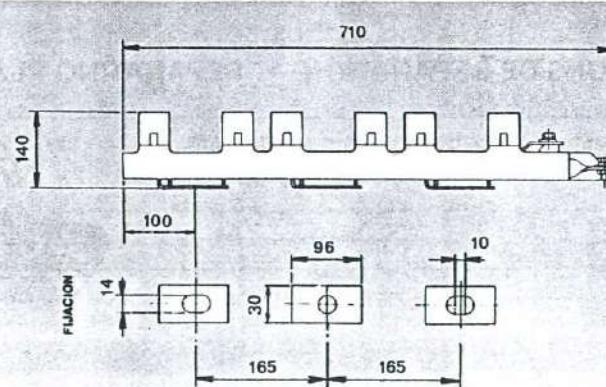
334160

TRIPOLARES ALINEADAS • TRIPOLAIRES ALIGNES • LINED-UP TRIPOLAR

NH 1 III	335250	250	1
NH 2 III	335400	400	1
NH 3 III	335630	630	1



335250


Normas:

UNE 21103
VDE 0636
IEC 269-1, IEC 269-2-1
DIN 43620
NFC 63210

Normes:

UNE 21103
VDE 0636
IEC 269-1, IEC 269-2-1
DIN 43620
NFC 63210

Standards:

UNE 21103
VDE 0636
IEC 269-1, IEC 269-2-1
DIN 43620
NFC 63210

ACCESORIOS ACCESSOIRES ACCESSORIES

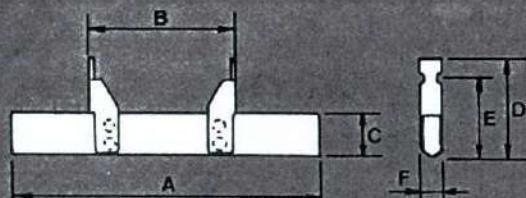
NH

NEUTROS SECCIONABLES • NEUTRES SECTIONNABLES • SECTIONNABLE NEUTRAL

TAMAÑO TAILLE SIZE	N.º ART. ART. N.	In (A)	CAJA/UN. CONDIT/UN. PACKING
00	340100	160	5
0	340160	160	5
1	340250	250	3
2	340400	400	3
3	340630	630	3
4	340125	1250	1



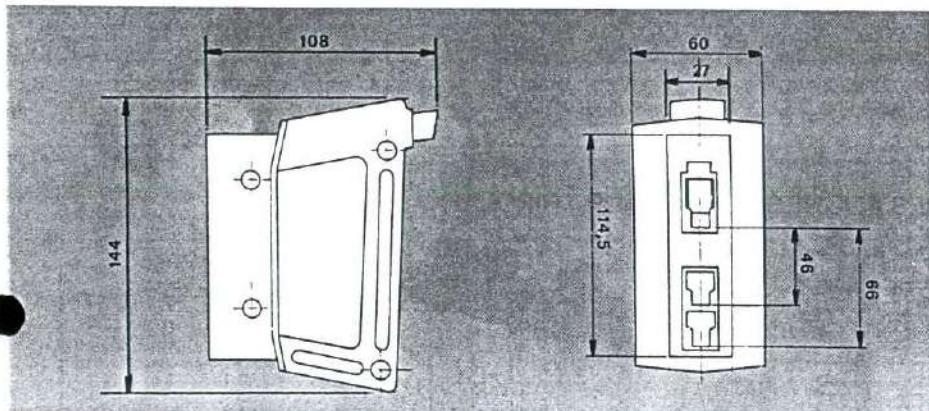
340250



	A	B	C	D	E	F
00	78,5	47	15	45	35	6
0	125	65	15	45	35	6
1	135	65	20	50	40	6
2	150	65	26	58	48	6
3	150	65	38	66,5	56,5	6
4	200	65	50	78	68	8

MANETA DE EXTRACCION • POIGNEE DE MANIPULATION • HANDLE

00 - 4 340001 3



340001

PLACAS DE SEPARACION • CLOISONS DE SEPARATION • SEPARATING PLATES

FIJACION PRESION • FIXATION PRESSION • PRESSURE FASTENING

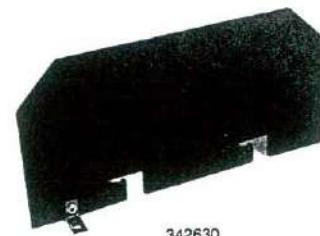
NH 00	341100	100	5
NH 0	341160	160	5
NH 1-2	341250	250/400	3
NH 3	341630	630	3



341250

FIJACION ESCUADRA • FIXATION EQUERRE • SQUARE FASTENING

NH 00	342100	100	5
NH 0	342160	160	5
NH 1-2	342250	250/400	3
NH 3	342630	630	1
NH 4	343125	1250	1

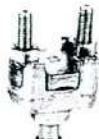


342630

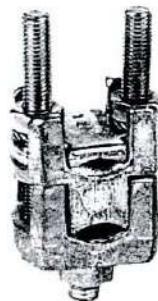
BORNES • BORNES • TERMINALS

1 CABLE • 1 CÂBLE • 1 CABLE

TAMAÑO TAILLE SIZE	N.º ART. ART. NO.	SECCION (mm ²) SECTION (mm ²) SECTION (mm ²)		CAJA/UN. CONDIT/UN. PACKING
		MAX	MIN	
00	343100	50	6	70
00 - 0	343160	95	10	50
1	343400	150	16	30
2 - 3	343630	240	50	15



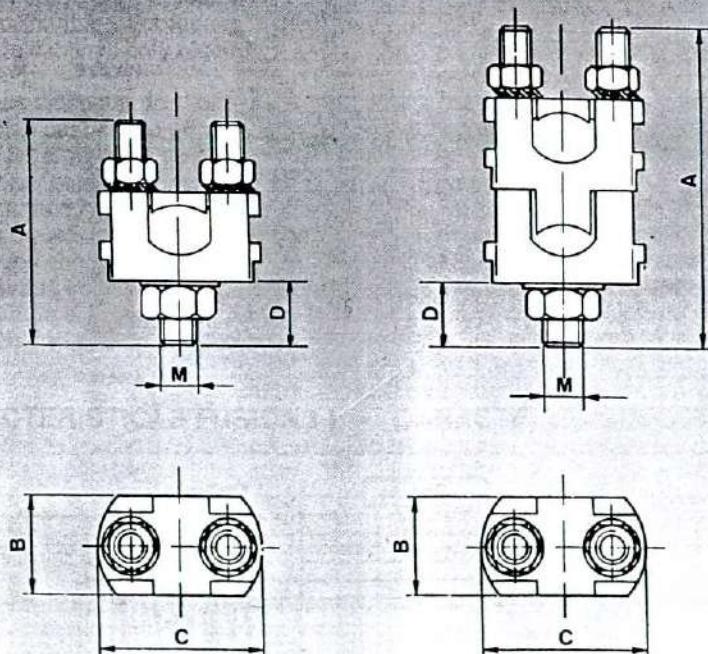
343160



344630

2 CABLES • 2 CÂBLES • 2 CABLES

00	344100	50	6	70
00 - 0	344160	95	10	30
1	344400	150	25 - 16	20
2 - 3	344630	240	95 - 50	5



N.º ART.	A	B	C	D	E
343100	34	17	25	10	6
343160	51	24	33	16	8
343400	58	25	40	17	10
343630	68	36	52	21	12
344100	44	17	25	10	6
344160	71	24	33	16	8
344400	83	25	40	17	10
344630	96	36	52	21	12

FUSIBLES CILINDRICOS DOMESTICOS

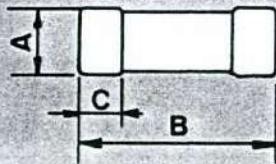
CARTOUCHES FUSIBLES CYLINDRIQUES DOMESTIQUES

DOMESTIC CYLINDRICAL FUSE-LINKS

Clase
Classe
Class

gF

TAMAÑO TAILLE SIZE	N.º ART. N.º ART.	SIN INDICADOR SANS VOYANT WHITHOUT INDICATOR	CON INDICADOR AVEC VOYANT WITH INDICATOR	In (A)	TENSION TENSION VOLTAGE (V)	PODER DE CORTE POUVOIR DE COUPURE BREAKING CAPACITY (kA)	CAJA/UN. CONDIT/UN. PACKING	
6,3 x 23	400002			2				
	400004			4				
	400006			* 6	250	6	10/100	
	400010			10				
8,5 x 23	410002	410002.0		2				
	410004	410004.0		4				
	410006	410006.0		6				
	410010	410010.0		* 10				
8,5 x 31,5	41010'5			0'5				
	410101			1				
	410102	410102.0		2				
	410104	410104.0		4				
	410106	410106.0		6				
	410108	410108.0		8				
	410110	410110.0		10	380/400	20	10/100	
	410112	410112.0		12				
	410116	410116.0		16				
	410120	410120.0		*20				
	410125	410125.0		25				
10,3 x 25,8	410206	410206.0		6				
	410210	410210.0		10	250	6	10/100	
	410216	410216.0		* 16				
10,3 x 31,5	410316	410316.0		16				
	410320	410320.0		20	380/400	20	10/100	
	410325	410325.0		* 25				
10,3 x 38	410425	410425.0		25				
	410432	410432.0		* 32	380/400	20	10/100	
8,5 x 36	410502	410502.0		2				
	410504	410504.0		4				
	410506	410506.0		6				
	410510	410510.0		10	380/400	20	10/100	
	410516	410516.0		16				
	410520	410520.0		20				
	410525	410525.0		25				
	410532	410532.0		32				



	A	B	C
623	6,3	23	5
823	8,5	23	5
1025	10,3	25,8	6,3
831	8,5	31,5	6,3
1031	10,3	31,5	6,3
836	8,5	36	6,3
1038	10,3	38	10

DATOS TECNICOS	DONNEES TECHNIQUES	TECHNICAL DATA
Tensión Nominal U _n	Tension Nominale U _n	Rated Voltage U _n
		250 V - 380 V (400 V)~
Intensidad Nominal I _n	Intensité Nominale I _n	Rated Current I _n
		6,3 x 23 2 A - 10 A 8,5 x 23 2 A - 10 A 10,3 x 25,8 6 A - 16 A 8,5 x 31,5 0,5 A - 25 A 10,3 x 31,5 16 A - 25 A 8,5 x 36 2 A - 32 A 10,3 x 38 25 A - 32 A
Poder de Corte I _b	Pouvoir de Coupure I _b	Breaking Capacity I _b
		6 kA - 250 V~ 20 kA - 380 V (400 V)~
Características Fusión	Caractéristiques de Fusion	Fusing Characteristics
		gF - aM
Normas	Normes	Standard publications
		IEC 269-1, IEC 269-3-1 NFC 61.201 UNE 21.103
Homologaciones	Homologations	Quality Marks
		NF-USE In(*)
Señalización	Signalisation	Signal
		Normal - Indicador



APLICACION

Los Cartuchos fusibles cilíndricos DF tipo doméstico, como su nombre indica, tienen su utilización en viviendas y en todo tipo de instalación doméstica para la protección de cortocircuitos y sobrecargas en líneas de iluminación y electrodomésticos.

Podemos distinguir dos tipos de características; el tipo gF de acción rápida, para proteger de cortocircuitos y evitar calentamientos, y el tipo aM destinado a proteger de cortocircuitos pequeños electrodomésticos equipados con motores que tienen una elevada intensidad de cresta en su arranque acompañados siempre de algún otro tipo de protección.

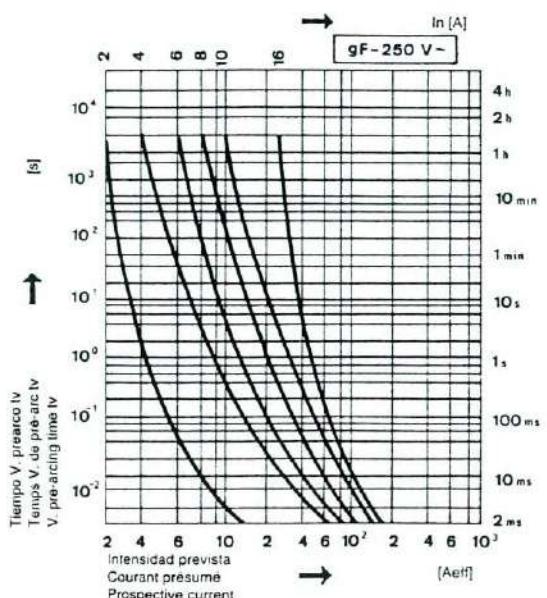
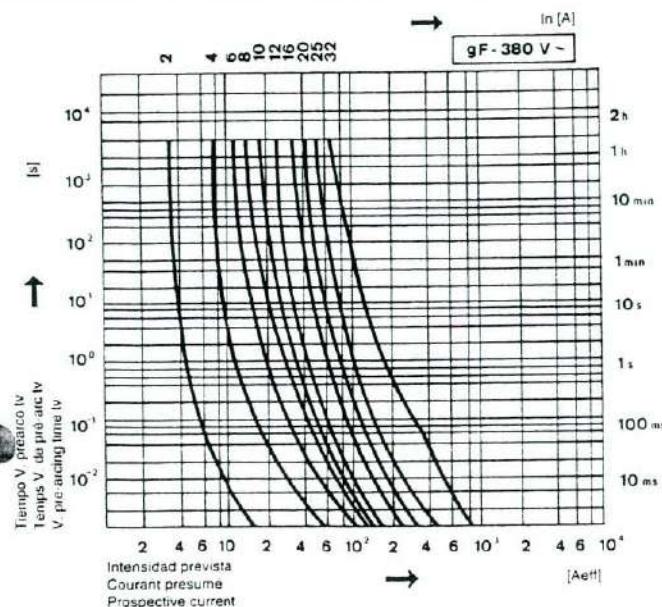
APPLICATION

Les cartouches fusibles cylindriques DF de type domestique, comme leur nom l'indique, sont utilisées dans les habitats et toutes sortes d'installations domestiques pour la protection de court-circuits et surcharges en lignes d'illumination et d'électroménagers.
Nous pouvons distinguer deux sortes de caractéristiques : gF d'action rapide contre les court-circuits, les échauffements, et le type aM destiné à protéger des électroménagers équipés de moteurs avec intensité de crête élevée au démarrage, toujours accompagnés d'autres modes de protection.

APPLICATION

Domestic cylindrical fuses-links DF are used in houses and all domestic installations to protect from short circuits, overloads in illumination lines and electro fittings. There are two kinds of breakers:
gF type, quick-acting, used for protection from short circuits, heatings;
aM type is used to protect small electro fittings with motor or peak voltage in their starter, combined with other protection elements.

CARACTERISTICAS FUSION t-I • CARACTÉRISTIQUES FUSION t-I • t-I CHARACTERISTICS MELTING



FUSIBLES CILINDRICOS INDUSTRIALES

CARTOUCHES FUSIBLES CYLINDRIQUES INDUSTRIELLES

INDUSTRIAL CYLINDRICAL FUSE-LINKS

Clase
Classe
Class **gl-gG**

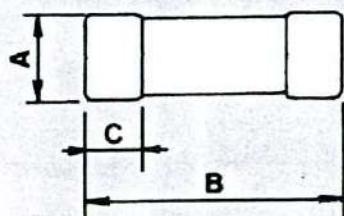
TAMAÑO TAILLE SIZE	In (A)	Nº. ART. SIN INDICADOR SANS VOYANT WITHOUT INDICATOR	CON INDICADOR AVEC VOYANT WITH INDICATOR	TENSION TENSION VOLTAGE (V)	PODER DE CORTE POUVOIR DE COUPURE BREAKING CAPACITY (kA)	CAJA/UN. CONDIT/UN. PACKING
8,5x31,5 gl-gG T-00	1	420501	420601			
	2	420502	420602			
	4	420504	420604			
	6	420506	420606			
	8	420508	420608			
	10	420510	420510			
	12	420512	420612			
	16	420516	420616			
	20	420520	420620			
	25	420525	420625			
10x38 gl-gG T-0	0,5	42000'5	42010'5	500	120	
	1	420001	420101			420006
	2	420002	420102			
	4	420004	420104			
	6	420006	420106			
	8	420008	420108			
	10	420010	420110			10/100
	12	420012	420112			
	16	420016	420116			
	20	420020	420120			
	25	420025	420125			
	32	420032	420132	400		
14x51 gl-gG T-1	1	421001	421101	660	80	
	2	421002	421102			
	4	421004	421104			
	6	421006	421106			421040
	8	421008	421108			
	10	421010	421110			
	12	421012	421112			10/50
	16	421016	421116			
	20	421020	421120			
	25	421025	421125			
	32	421032	421132	500	120	
	40	421040	421140			
	50	421050	421150	400		
22x58 gl-gG T-2	2	422002	422102	660	80	
	4	422004	422104			
	6	422006	422106			
	8	422008	422108			
	10	422010	422110			
	12	422012	422112			
	16	422016	422116			
	20	422020	422120			
	25	422025	422125			10/50
	32	422032	422132			
	40	422040	422140			
	50	422050	422150			
	63	422063	422163			
	80	422080	422180			
	100	422000	422100	500	120	
	125	422015	422115	400		

NEUTRO • NEUTRE • NEUTRAL

8 x 31	N	430000	10/100	
10 x 38	N	431000	10/100	
14 x 51	N	432000	10/50	
22 x 58	N	433000	10/50	433000

Clase
Classe aM
Class

TAMAÑO TAILLE SIZE	In (A)	Nº. ART. SIN INDICADOR SANS VOYANT WITHOUT INDICATOR	CON INDICADOR AVEC VOYANT WITH INDICATOR	TENSIÓN TENSION VOLTAGE (V)	PODER DE CORTE POUVOIR DE COUPURE BREAKING CAPACITY (KA)	CAJA/UN. CONDIT/UN. PACKING
8,5x31,5						
	1	411101				
	2	411102				
	4	411104				
	6	411106		380/400	20	10/100
	8	411108				
	10	411110				
10x38	0,16	44000'16		500	120	
aM	0,25	44000'25				
T-0	0,5	44000'5				
	1	440001	440101			
	2	440002	440102			
	4	440004	440104			
	6	440006	440106			10/100
	8	440008	440108			
	10	440010	440110			
	12	440012	440112			
	16	440016	440116			
	20	440020	440120			
	25	440025	440125	400		
14x51	0,25	44100'25		660	80	
aM	0,5	44100'5				
T-1	1	441001	441101			
	2	441002	441102			
	4	441004	441104			
	6	441006	441106			
	8	441008	441108			
	10	441010	441110			
	12	441012	441112			10/50
	16	441016	441116			
	20	441020	441120			
	25	441025	441125			
	32	441032	441132	500	120	
	40	441040	441140			
	50	441050	441150	400		
22x58	2	442002	442102	660	80	
aM	4	442004	442104			
T-2	6	442006	442106			
	8	442008	442108			
	10	442010	442110			
	12	442012	442112			
	16	442016	442116			
	20	442020	442120			
	25	442025	442125			10/50
	32	442032	442132			
	40	442040	442140			
	50	442050	442150			
	63	442063	442163			
	80	442080	442180			
	100	442000	442100	500	120	
	125	442015	442115	400		

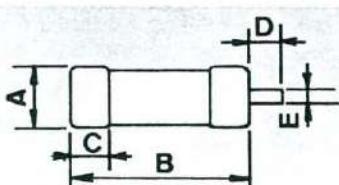


	10 x 38	14 x 51	22 x 58
A	10,3	14,3	22,2
B	38	51	58
C	10,5	13,8	16,2

**FUSIBLES CILINDRICOS INDUSTRIALES CON PERCUTOR
CARTOUCHES FUSIBLES CYLINDRIQUES INDUSTRIELLES AVEC PERCUTEUR
INDUSTRIAL CYLINDRICAL FUSE-LINKS WITH STRIKER**

Clase
Classe
Class **gl-gG / aM**

TAMAÑO TAILLE SIZE	In (A)	N.º ART.	TENSION TENSION VOLTAGE (V)	PODER DE CORTE POUVOIR DE COUPURE BREAKING CAPACITY (kA)	CAJA/UN. CONDIT/UN. PACKING	
14 x 51 gl - gG T-1	2 4 6 8 10 12 16 20 25 32 40 50	421202 421204 421206 421208 421210 421212 421216 421220 421225 421232 421240 421250	500			
				120	10/50	421216
22 x 58 gl - gG T-2	4 6 8 10 12 16 20 25 32 40 50 63 80 100 125	422204 422206 422208 422210 422212 422216 422220 422225 422232 422240 422250 422263 422280 422200 422215	660	80		
					10/50	422240
14 x 51 aM T-1	1 2 4 6 8 10 12 16 20 25 32 40 50	441201 441202 441204 441206 441208 441210 441212 441216 441220 441225 441232 441240 441250	500	120		
					10/50	441225
22 x 58 aM T-2	1 2 4 6 8 10 12 16 20 25 32 40 50 63 80 100 125	442201 442202 442204 442206 442208 440210 442212 442216 442220 442225 442232 442240 442250 442263 442280 442200 442215	660 500 400	80 120		



	14 x 51	22 x 58
A	14,3	22,2
B	51	58
C	11	15
D	8	8
E	4	4

<u>DATOS TECNICOS</u>	<u>DONNEES TECHNIQUES</u>	<u>TECHNICAL DATA</u>		
Tensión Nominal U _n	Tension Nominale U _n	Rated Voltage U _n	660 - 500 - 400 V~	
Intensidad Nominal I _n	Intensité Nominale I _n	Rated Current I _n	8 x 31	1 A - 20 A
			10 x 38	0,5 A - 32 A
			14 x 51	1 A - 50 A
			22 x 58	2 A - 125 A
Poder de Corte I _b	Pouvoir de Coupure I _b	Breaking Capacity I _b	120 kA - 500 V ~ 80 kA - 660 V ~	
Características Fusión	Caractéristiques de Fusion	Fusing Characteristics	(gl - gG), aM	
Señalización	Signalisation	Signal	Normal - Indicador - Percutor	
Normas	Normes	Standard publications	IEC 269-1, IEC 269-2-1 NFC 63.210, 63.211 UNE 21.103	

APLICACION

Los Cartuchos Fusibles DF del tipo cilíndrico Industrial, tienen su aplicación en instalaciones industriales de todo tipo.

Podemos distinguir dos tipos en función de sus características de fusión:
gl de fusión lenta-rápida, siendo lenta para pequeñas sobreintensidades y rápida para grandes sobreintensidades (cortocircuito) adecuado para todo tipo de instalaciones.

aM utilizado específicamente como acompañamiento de motores para protección en cortocircuito; pero admite intensidades de cresta elevadas.

APPLICATION

Les cartouches fusibles DF de type cylindrique industriel, sont utilisées dans les installations industrielles de tout genre.

Nous pouvons distinguer deux types en fonction de leurs caractéristiques de fusion.

gl Fusion lente-rapide, lente pour les petites surintensités et rapide pour les grandes (court-circuits), qui s'adapte à toutes sortes d'installations.

aM est spécifiquement utilisé comme accompagnement de moteurs pour protection en court-circuits mais admet des intensités de crête élevées.

APPLICATION

Industrial cylindrical fuse-links DF, are used in industrial installations and similar.

There are two kinds of breakers according to their fusing characteristics.

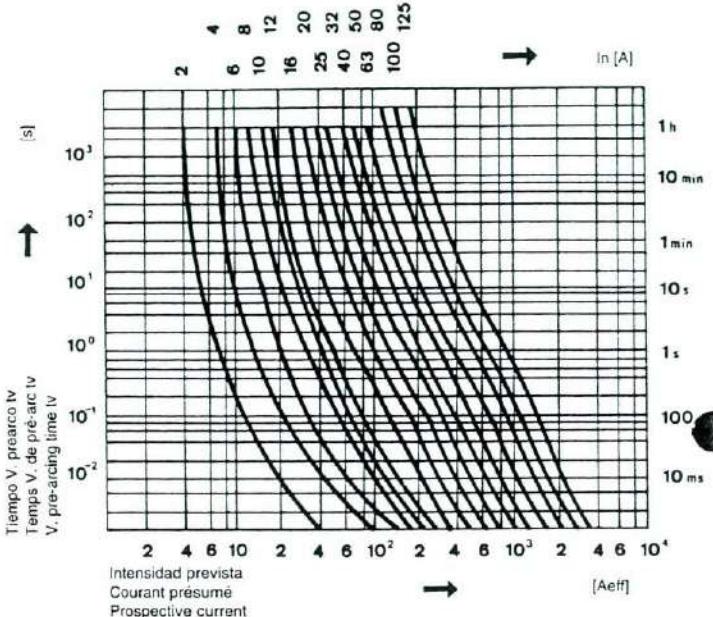
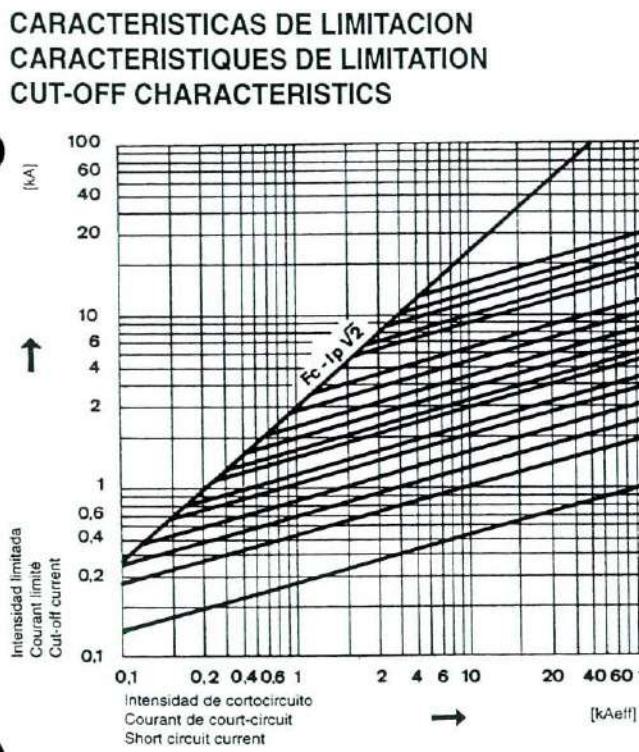
gl slow-quick fusing, slow for small overcurrents, quick for big overcurrents (short circuits) and adapted to all type installations.

aM is specifically used as accompaniment of motors for short circuits protection but admits hight current peaks.

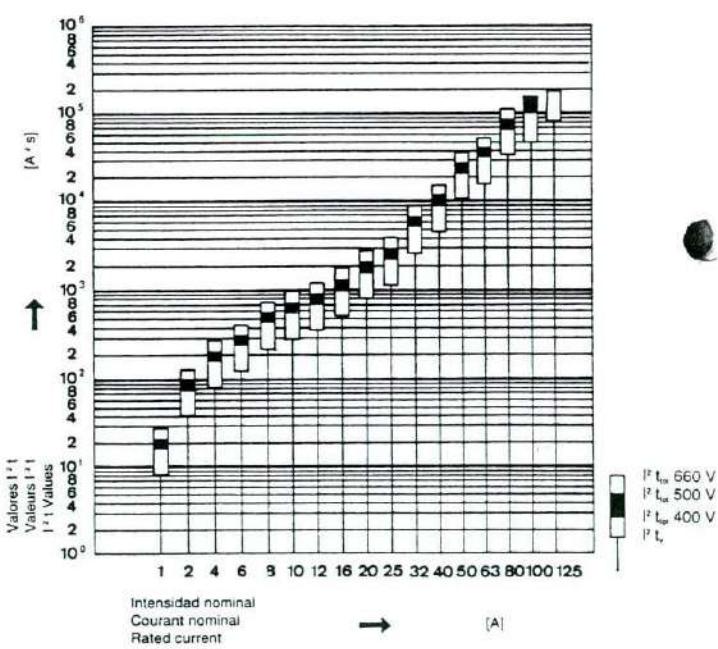
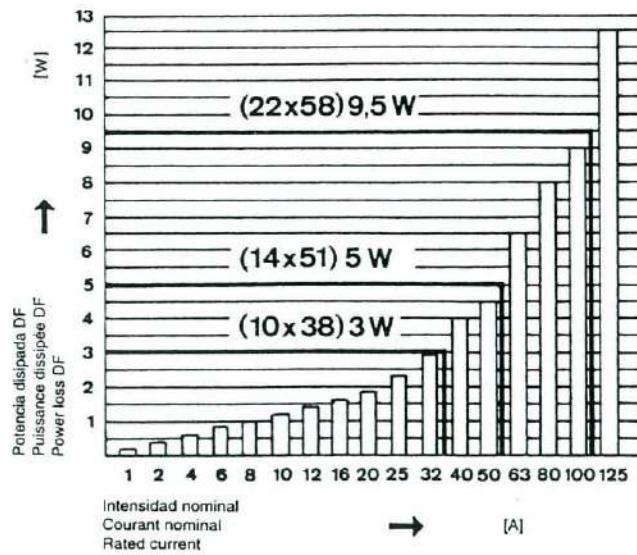
FUSIBLES CILINDRICOS INDUSTRIALES CARTOUCHES FUSIBLES CYLINDRIQUES INDUSTRIELLES INDUSTRIAL CYLINDRICAL FUSE-LINKS

Clase
Classe
Class **gl-gG**

CARACTERISTICAS FUSION t-I CARACTERISTIQUES FUSION t-I t-I MELTING CHARACTERISTICS



POTENCIA DISIPADA PUISANCE DISSIPEE POWER LOSS

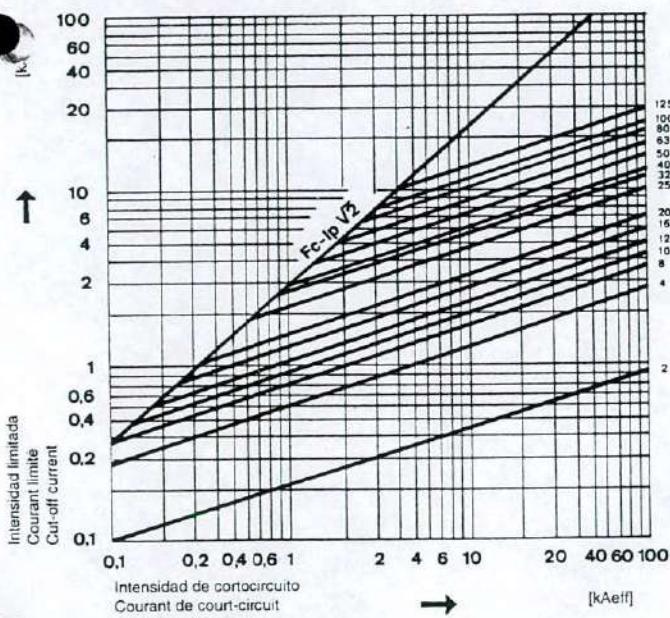


NORMAS NORMES S. PUBLIC.	TALLA TAILLE SIZE	A	W
IEC 269-2	10 X 38	25	3
NFC 63210	14 X 51	40	5
UNE 21103	22 X 58	100	9

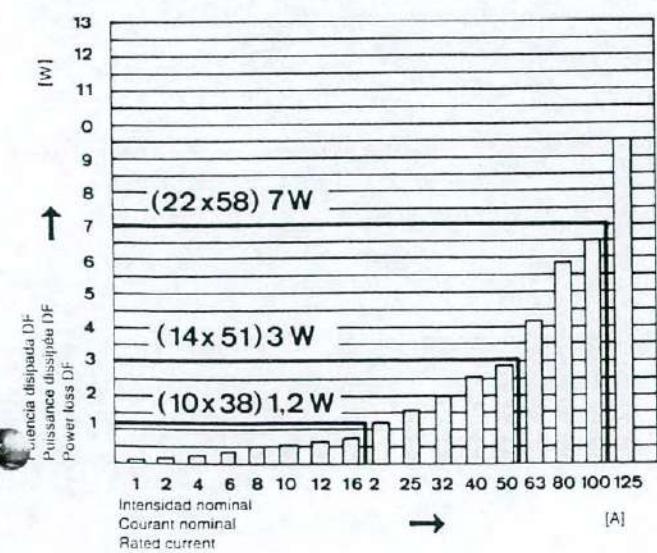
Clase
Classe
Class

aM

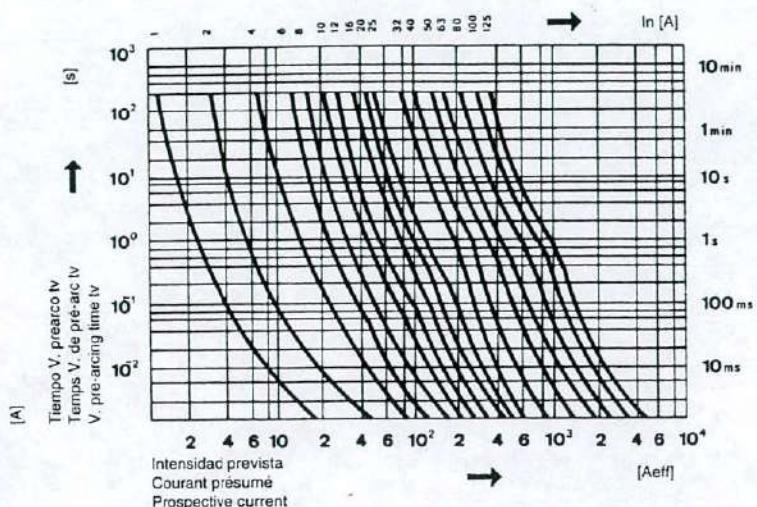
CARACTERISTICAS DE LIMITACION CARACTERISTIQUES DE LIMITATION CUT-OFF CHARACTERISTICS



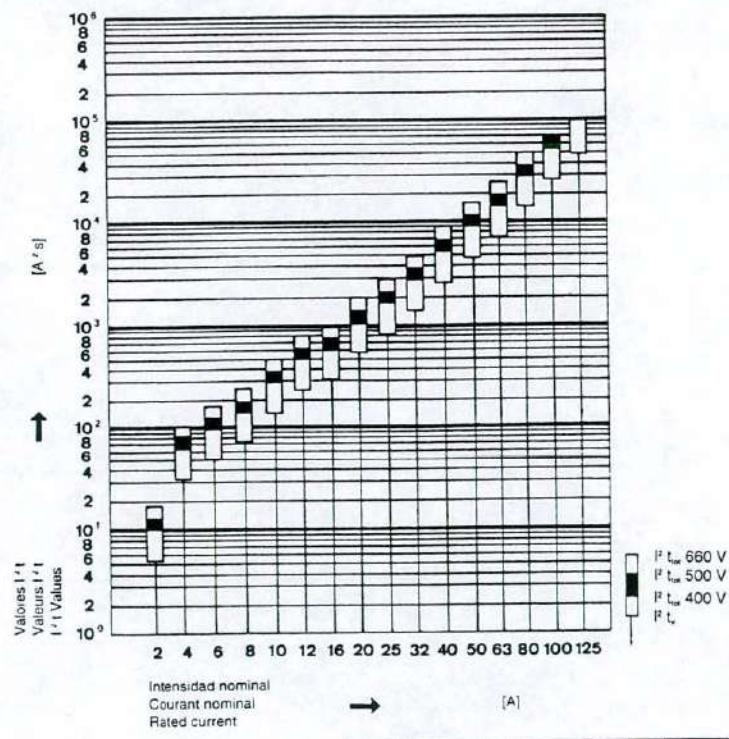
POTENCIA DISIPADA PUISANCE DISSIPEE POWER LOSS



CARACTERISTICAS FUSION t-I CARACTERISTIQUES FUSION t-I t-I MELTING CHARACTERISTICS



SELECTIVIDAD I^2t SELECTIVITE I^2t I^2t SELECTIVITY



NORMAS NORMES S. PUBLIC.	TALLA TAILLE SIZE	A	W
IEC 269-2	10 X 38	16	1,2
NFC 63210	14 X 51	50	3
UNE 21103	22 X 58	100	7

HI

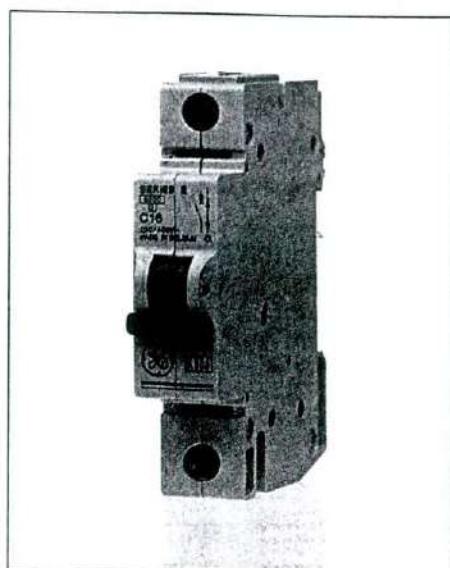


Standard: IEC 898

Characteristic

C	B	D	Poles	In (A)	Mod.
12	V/099-004102	V/099-034102	1	2	1
12	V/099-004104	V/099-034104	1	4	1
12	V/099-004106	V/099-034106	1	6	1
12	V/099-004110	V/099-034110	1	10	1
12	V/099-004116	V/099-034116	1	16	1
12	V/099-004120	V/099-034120	1	20	1
12	V/099-004125	V/099-034125	1	25	1
12	V/099-004132	V/099-034132	1	32	1
12	V/099-004140	V/099-034140	1	(40)	1
12	V/099-006140	V/099-036140	1	40	1
12	V/099-006150	V/099-036150	1	50	1
12	V/099-006163	V/099-036163	1	63	1
6	V/099-004202	V/099-034202	2	2	2
	V/099-004204	V/099-034204	2	4	2
	V/099-004206	V/099-034206	2	6	2
6	V/099-004210	V/099-034210	2	10	2
6	V/099-004216	V/099-034216	2	16	2
6	V/099-004220	V/099-034220	2	20	2
6	V/099-004225	V/099-034225	2	25	2
6	V/099-004232	V/099-034232	2	32	2
6	V/099-004240	V/099-034240	2	(40)	2
6	V/099-006240	V/099-036240	2	40	2
6	V/099-006250	V/099-036250	2	50	2
6	V/099-006263	V/099-036263	2	63	2
4	V/099-004302	V/099-034302	3	2	3
4	V/099-004304	V/099-034304	3	4	3
4	V/099-004306	V/099-034306	3	6	3
4	V/099-004310	V/099-034310	3	10	3
4	V/099-004316	V/099-034316	3	16	3
4	V/099-004320	V/099-034320	3	20	3
4	V/099-004325	V/099-034325	3	25	3
4	V/099-004332	V/099-034332	3	32	3
4	V/099-004340	V/099-034340	3	(40)	3
	V/099-006340	V/099-036340	3	40	3
	V/099-006350	V/099-036350	3	50	3
	V/099-006363	V/099-036363	3	63	3
3	V/099-004502	V/099-034502	3+N	2	4
3	V/099-004504	V/099-034504	3+N	4	4
3	V/099-004506	V/099-034506	3+N	6	4
3	V/099-004510	V/099-034510	3+N	10	4
3	V/099-004516	V/099-034516	3+N	16	4
3	V/099-004520	V/099-034520	3+N	20	4
3	V/099-004525	V/099-034525	3+N	25	4
3	V/099-004532	V/099-034532	3+N	32	4
3	V/099-004540	V/099-034540	3+N	(40)	4
3	V/099-006540	V/099-036540	3+N	40	4
3	V/099-006550	V/099-036550	3+N	50	4
3	V/099-006563	V/099-036563	3+N	63	4

40 - 50 - 63A: Series G

For add-on RCD 63A:
order Series G10000
(p. 19)(40): Add-on RCD's
not available

Short-circuit capacity

	6000
In(A)	2 - 40 40 - 50 - 63
1P	230/400V~ 230/400V~
2P/1P+N	230V~ 400V~
3P	400V~ 400V~
3P+N/4P	400V~ 400V~

Use at D.C.

	1P	2P*
Short-circuit capacity	6000A	6000A
Max. voltage	48V	110V

* Poles in series

Series E6000/G6000 on request

	B	C	D
4P	x	x	x
1P+N (2mod)	x	x	x

Extensions

	Series E	Series G
Add-on RCD's	p. 40	p. 40
Display contacts	p. 54	p. 54
Accessories	p. 45	p. 46
Tele L	p. 25	p. 25
Busbar systems	p. 57	p. 57

Approvals

KEMA (1)
KEUR

(1) Except D-characteristic

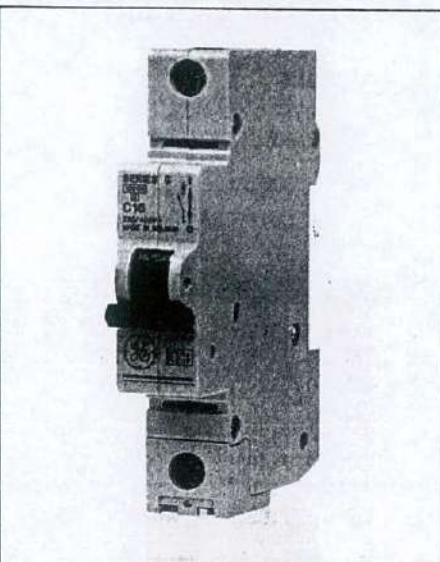
	Series E	Series G
Technical data	p. 17	p. 28
Dimensions	p. 84	p. 84



Standard: IEC 898

Characteristic

C	B	D	Poles	In (A)	Mod.
12	V/099-007100	V/099-037100	1	0.5	1
12	V/099-007101	V/099-037101	1	1	1
12	V/099-007102	V/099-037102	1	2	1
12	V/099-007104	V/099-037104	1	4	1
12	V/099-007106	V/099-037106	1	6	1
12	V/099-007110	V/099-037110	1	10	1
12	V/099-007116	V/099-037116	1	16	1
12	V/099-007120	V/099-037120	1	20	1
12	V/099-007125	V/099-037125	1	25	1
12	V/099-007132	V/099-037132	1	32	1
12	V/099-007140	V/099-037140	1	40	1
12	V/099-007150	V/099-037150	1	50	1
12	V/099-007163	V/099-037163	1	63	1
6	V/099-007200	V/099-037200	2	0.5	2
	V/099-007201	V/099-037201	2	1	2
	V/099-007202	V/099-037202	2	2	2
0	V/099-007204	V/099-037204	2	4	2
6	V/099-007206	V/099-037206	2	6	2
6	V/099-007210	V/099-037210	2	10	2
6	V/099-007216	V/099-037216	2	16	2
6	V/099-007220	V/099-037220	2	20	2
6	V/099-007225	V/099-037225	2	25	2
6	V/099-007232	V/099-037232	2	32	2
6	V/099-007240	V/099-037240	2	40	2
6	V/099-007250	V/099-037250	2	50	2
6	V/099-007263	V/099-037263	2	63	2
6	V/099-007265	V/099-037265	2	63	2.5
4	V/099-007300	V/099-037300	3	0.5	3
4	V/099-007301	V/099-037301	3	1	3
4	V/099-007302	V/099-037302	3	2	3
4	V/099-007304	V/099-037304	3	4	3
4	V/099-007306	V/099-037306	3	6	3
4	V/099-007310	V/099-037310	3	10	3
4	V/099-007316	V/099-037316	3	16	3
4	V/099-007320	V/099-037320	3	20	3
4	V/099-007325	V/099-037325	3	25	3
4	V/099-007332	V/099-037332	3	32	3
4	V/099-007340	V/099-037340	3	40	3
4	V/099-007350	V/099-037350	3	50	3
4	V/099-007363	V/099-037363	3	63	3
4	V/099-007365	V/099-037365	3	63	4
3	V/099-007500	V/099-037500	3+N	0.5	4
3	V/099-007501	V/099-037501	3+N	1	4
3	V/099-007502	V/099-037502	3+N	2	4
3	V/099-007504	V/099-037504	3+N	4	4
3	V/099-007506	V/099-037506	3+N	6	4
3	V/099-007510	V/099-037510	3+N	10	4
3	V/099-007516	V/099-037516	3+N	16	4
3	V/099-007520	V/099-037520	3+N	20	4
3	V/099-007525	V/099-037525	3+N	25	4
3	V/099-007532	V/099-037532	3+N	32	4
3	V/099-007540	V/099-037540	3+N	40	4
3	V/099-007550	V/099-037550	3+N	50	4
3	V/099-007563	V/099-037563	3+N	63	4
3	V/099-007565	V/099-037565	3+N	63	5.5

V/099-xxxx65:
for add-on RCD 63A

Short-circuit capacity

	10000
In(A)	0.5 - 63
1P	230/400V~
2P/1P+N	400V~
3P	400V~
3P+N/4P	400V~

Use at D.C.

	1P	2P*
Short-circuit capacity	10000A	10000A
Max. voltage	48V	110V

* Poles in series

Series G10000 on request

	B	C	D
4P	X	X	X
1P+N (2mod)	X	X	X

Extensions

Add-on RCD's	p. 40
Display contacts	p. 54
Accessories	p. 46
Busbar systems	p. 57
Tele L	p. 25
mU	p. 27
Tele M	p. 26

Approvals

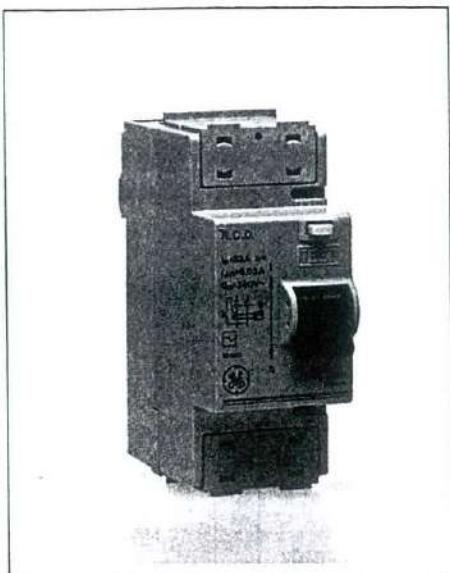
KEMA (1)
KEUR

(1) Except D-characteristic

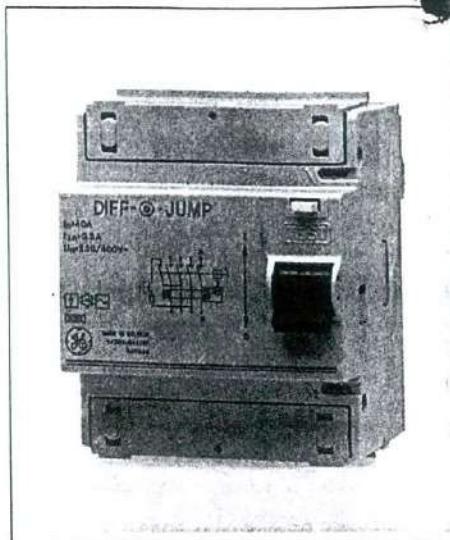
Technical data	p. 28
Dimensions	p. 84



2 modules
Connections:
1P+N, 2P



4 modules
Connections:
1P+N, 2P, 3P,
3P+N, 4P

**Type A**

30mA	100mA	300mA	500mA	
V/304-022030	V/304-022100	V/304-022300	V/304-022500	25A
V/304-024030	V/304-024100	V/304-024300	V/304-024500	40A
V/304-026030	-	V/304-026300	V/304-026500	63A
V/304-028030	-	-	-	80A
V/304-029030	-	-	-	100A
V/304-021010 (10mA)				16A

Type A S

-	-	V/304-024302	V/304-024502	40A
-	-	V/304-026302	V/304-026502	63A

Type A G

-	-	-	-	-
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Type AC

V/304-022031	V/304-022101	V/304-022301	V/304-022501	25A
V/304-024031	V/304-024101	V/304-024301	V/304-024501	40A
V/304-026031	V/304-026101	V/304-026301	V/304-026501	63A
V/304-028031	V/304-028101	V/304-028301	V/304-028501	80A
V/304-029031	V/304-029101	V/304-029301	V/304-029501	100A
V/304-021011 (10mA)				16A

Type A

30mA	100mA	300mA	500mA	
V/304-042030	V/304-042100	V/304-042300	V/304-042500	25A
V/304-044030	V/304-044100	V/304-044300	V/304-044500	40A
V/304-046030	V/304-046100	V/304-046300	V/304-046500	63A
-	V/304-048100	V/304-048300	V/304-048500	80A
-	V/304-049100	V/304-049300	V/304-049500	100A

Type A S

-	-	V/304-044302	V/304-044502	40A
-	-	V/304-046302	V/304-046502	63A
-	-	V/304-049302	V/304-049502	100A ⁽¹⁾

Type A G

V/304-044034	V/304-044104	-	-	40A
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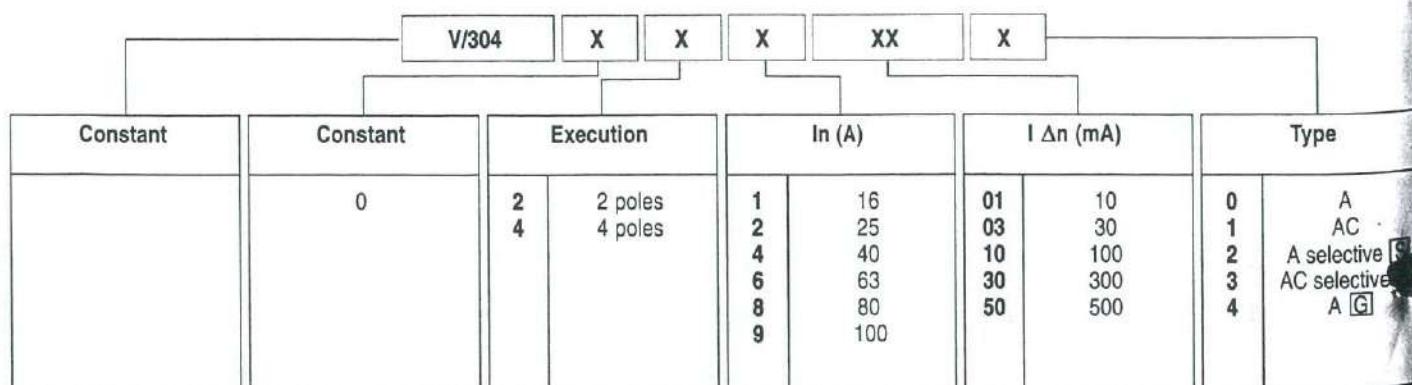
Type AC

V/304-042031	V/304-042101	V/304-042301	V/304-042501	25A
V/304-044031	V/304-044101	V/304-044301	V/304-044501	40A
V/304-046031	V/304-046101	V/304-046301	V/304-046501	63A
-	V/304-048101	V/304-048301	V/304-048501	80A
-	V/304-049101	V/304-049301	V/304-049501	100A

Package = 1

(1) On request

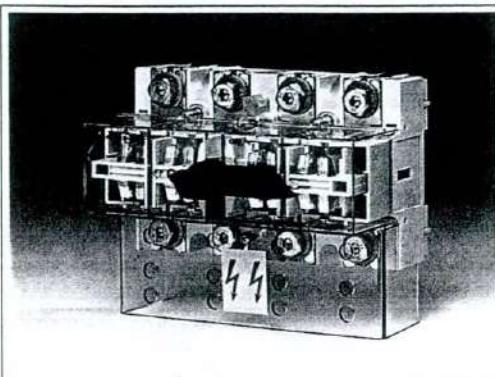
Dimensions: p. 86

Catalogue number structure for RCCB's Diff-o-Jump

Dilos 2

Disconnector loadbreak switches

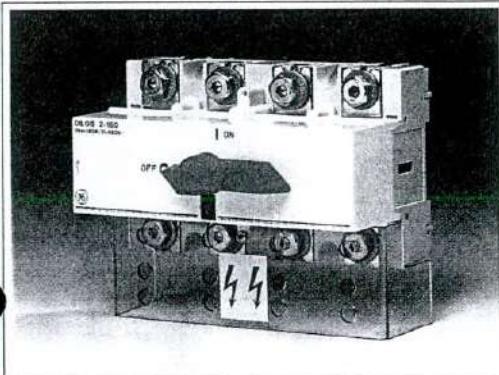
Transparent padlockable DIN-rail switch. 160A - 200A



1	D/061224-201	160A	2P
1	D/061324-201	160A	3P
1	D/061424-201	160A	4P
1	D/061524-201	160A	3P + fixed N
1	D/061226-201	200A	2P
1	D/061326-201	200A	3P
1	D/061426-201	200A	4P
*	D/061526-201	200A	3P + fixed N

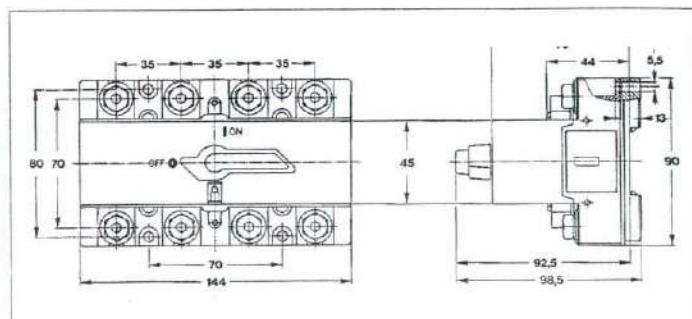
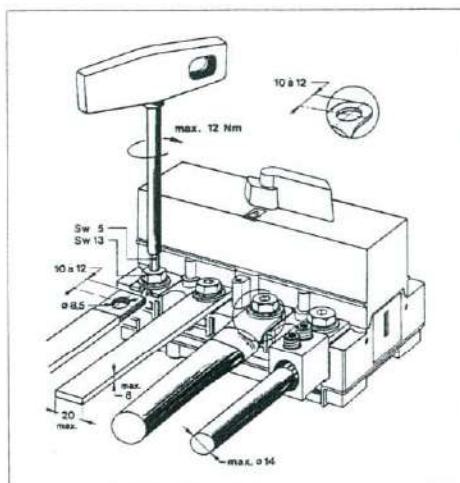
Safety loadbreak switch

Red/yellow type, according to VDE 0113 and padlockable.



1	D/061324-203	160A	3P
1	D/061424-203	160A	4P
1	D/061326-203	200A	3P
1	D/061426-203	200A	4P

Switches are always delivered with a red handle and one terminal cover.



Accessories

1	D/061922-003
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Set of three mantle terminals.

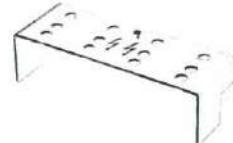


1	D/061922-004
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Set of four mantle terminals.

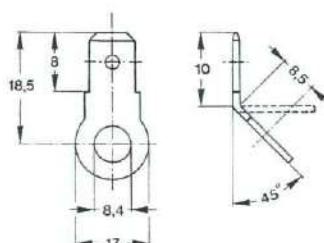
1	D/061922-020
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Terminal cover

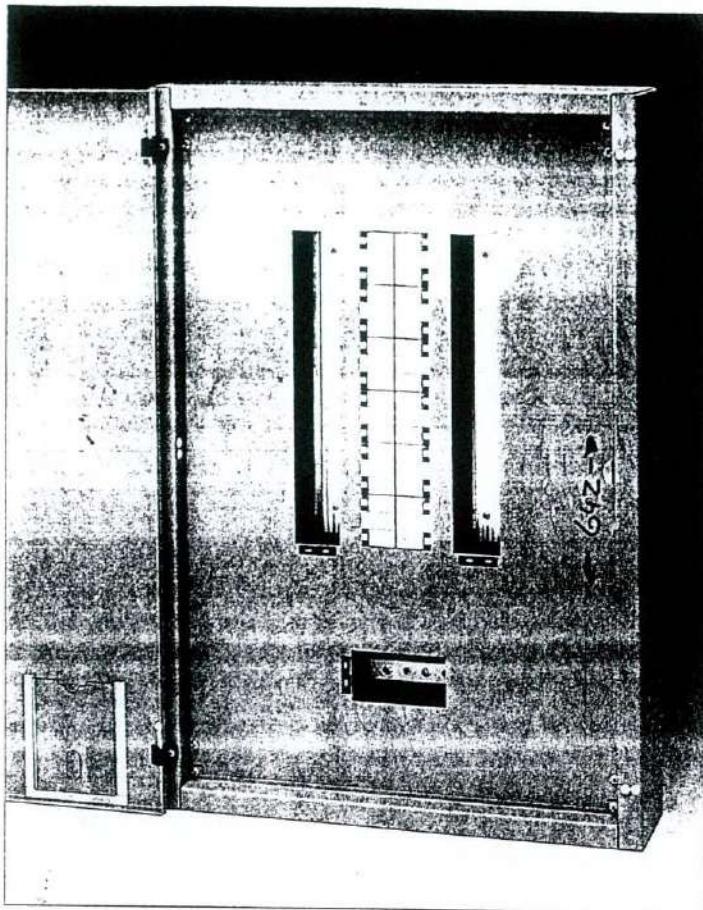


1	D/061922-030
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Set of 10 tabs (Faston) 6.3 x 0.8 mm
for 2.5 mm² connections.



TP&N Type B Distribution Boards



Distribution boards, designed to accept standard 6kA and 10kA MCBs.

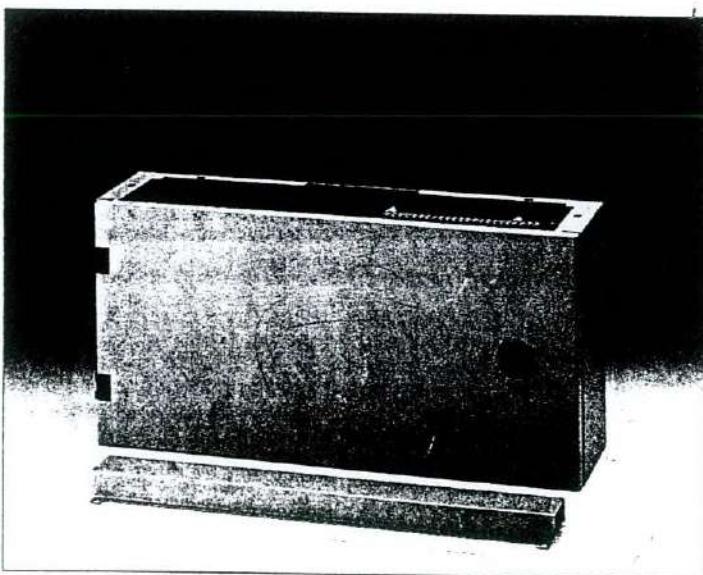
MOD DB40 4 way TP&N (12W24S)
H534.W500.D135
Ref. 619100

MOD DB60 6 way TP&N (18W24S)
H588.W500.D135
Ref. 619101

MOD DB80 8 way TP&N (24W24S)
H642.W500.D135
Ref. 619102

MOD DB120 12 way TP&N (36W24S)
H750.W500.D135
Ref. 619103

MOD DB180 18 way TP&N (54W24S)
H912.W500.D135
Ref. 619104



Cross bar supports are supplied with extension box and spreader box. Full fitting instructions and top plate are supplied with the main board.

Extension box

MOD 18D 18 way
H250.W500.D135
Ref. 619105

Spreader box

MOD SB1
H250.W500.D135
Ref. 619106

End plate

MOD HDGP Heavy duty end plate
Ref. 619116

Direct connection kit

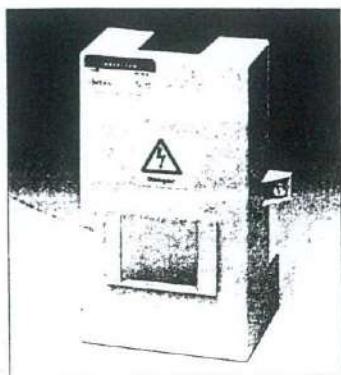
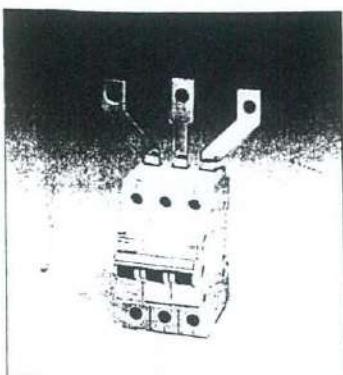
MOD DC With moulded cover
Ref. 619115

Single phase conversion kit

MOD SPK With moulded terminal cover
Ref. 618300



Incoming devices (main board)

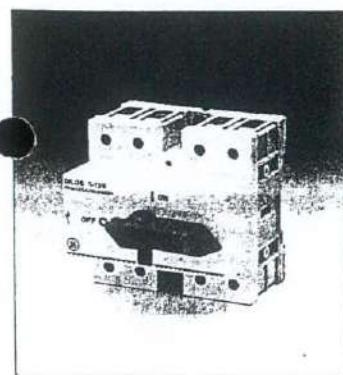


To install in the main board and complete with solid copper links and shroud.

MOD ISO3 100A, 3 pole isolator switch
Ref. 619111

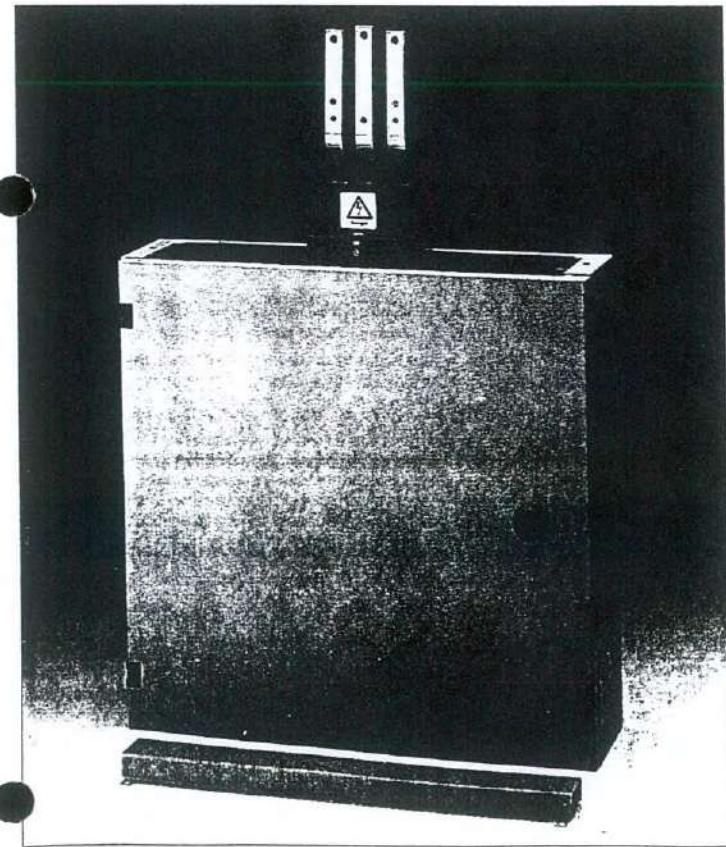
MOD RCDB 100A, 100mA 4 pole RCD
Ref. 619112

MOD RCDC 100A, 300mA, 4 pole RCD
Ref. 619113



MOD DIL125 125A, DILOS loadbreak switch
Ref. 619114

Incoming devices (add-on unit)



To install as separate incomer and complete with enclosure, solid copper links and shroud.

MOD DIL200 200A, DILOS loadbreak switch
H250.W500.D135
Ref. 619110

MOD MC200A 200A, MCCB automatic
H500.W500.D135
Ref. 619109

MOD MC200NA 200A, MCCB non-automatic
Ref. 619107

MOD MC200RCD 200A, MCCB with RCD
Ref. 619108