

THE ABC OF SWITCHBOARD MAINTENANCE

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Blacktown City Switchboards



National Electrical Switchboard Manufacturers Association





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DEFINITIONS

Maintenance – “ a combination of acts carried out to retain an item in, or restore it to, an acceptable condition”.

Acceptable condition – “ the condition in which an item is able to perform its required function and/or meet the relevant specification”.



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DEFINITIONS

Non-routine maintenance

Preventative maintenance

Post fault maintenance

Repair or corrective maintenance

Routine maintenance



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WHY MAINTAIN

Economics

Responsibility

AS3439.1:2002 Clause 5.3

“ It is the responsibility of the owner of the ASSEMBLY to institute a system of maintenance. The manufacturer’s recommendations should be addressed, together with the recommendations of AS2467, in a planned preventative maintenance programme. This will minimise the risk of injury or breakdown and the consequent human suffering and/or loss of supply”.



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WHAT & HOW TO MAINTAIN

The Metalwork



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WHAT & HOW TO MAINTAIN

The Busbar System



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WHAT & HOW TO MAINTAIN

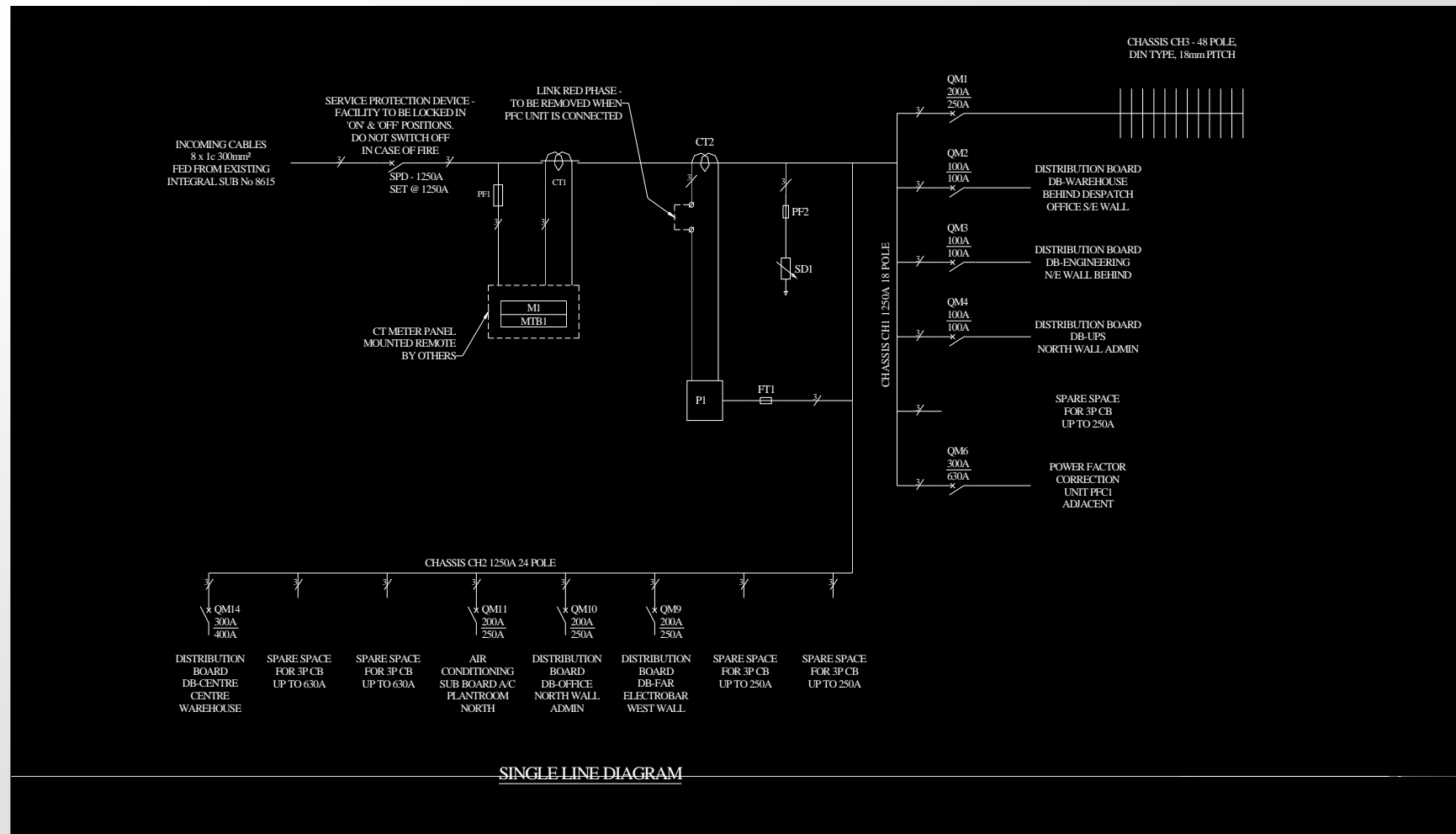
The Busbar System



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Main Switchboard



Service Protection Device



Service Protection Device

Why and what has to be maintained on breakers ?

- Case
- Mechanism
- Arc chute
- Main contacts
- Control unit
- Connection systems
- Auxiliary Devices
- Communication system



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Revenue CT's



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Surge Diverter



ATS /MTS



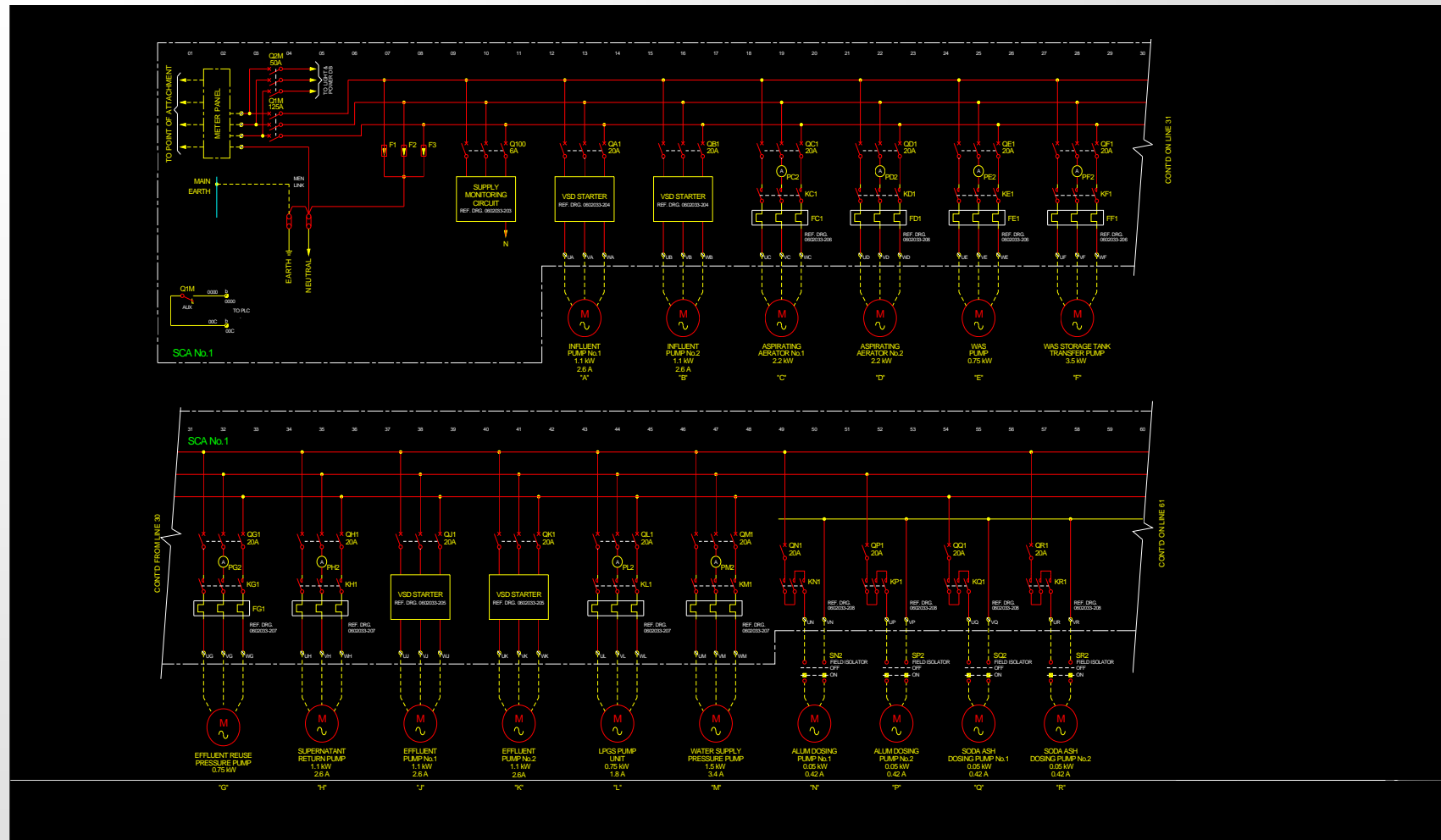
Outgoing Circuit Breakers



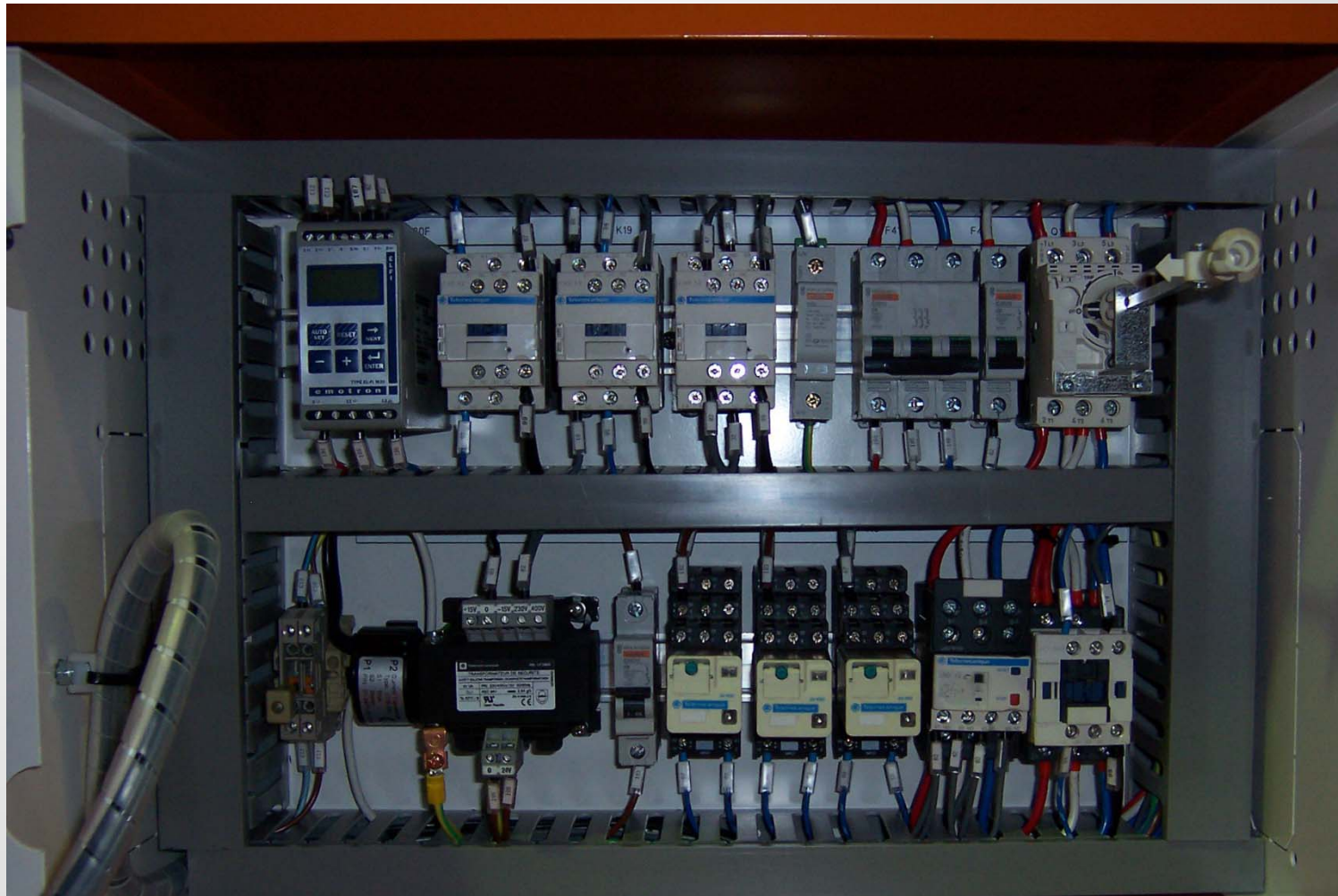
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Motor Control Centre



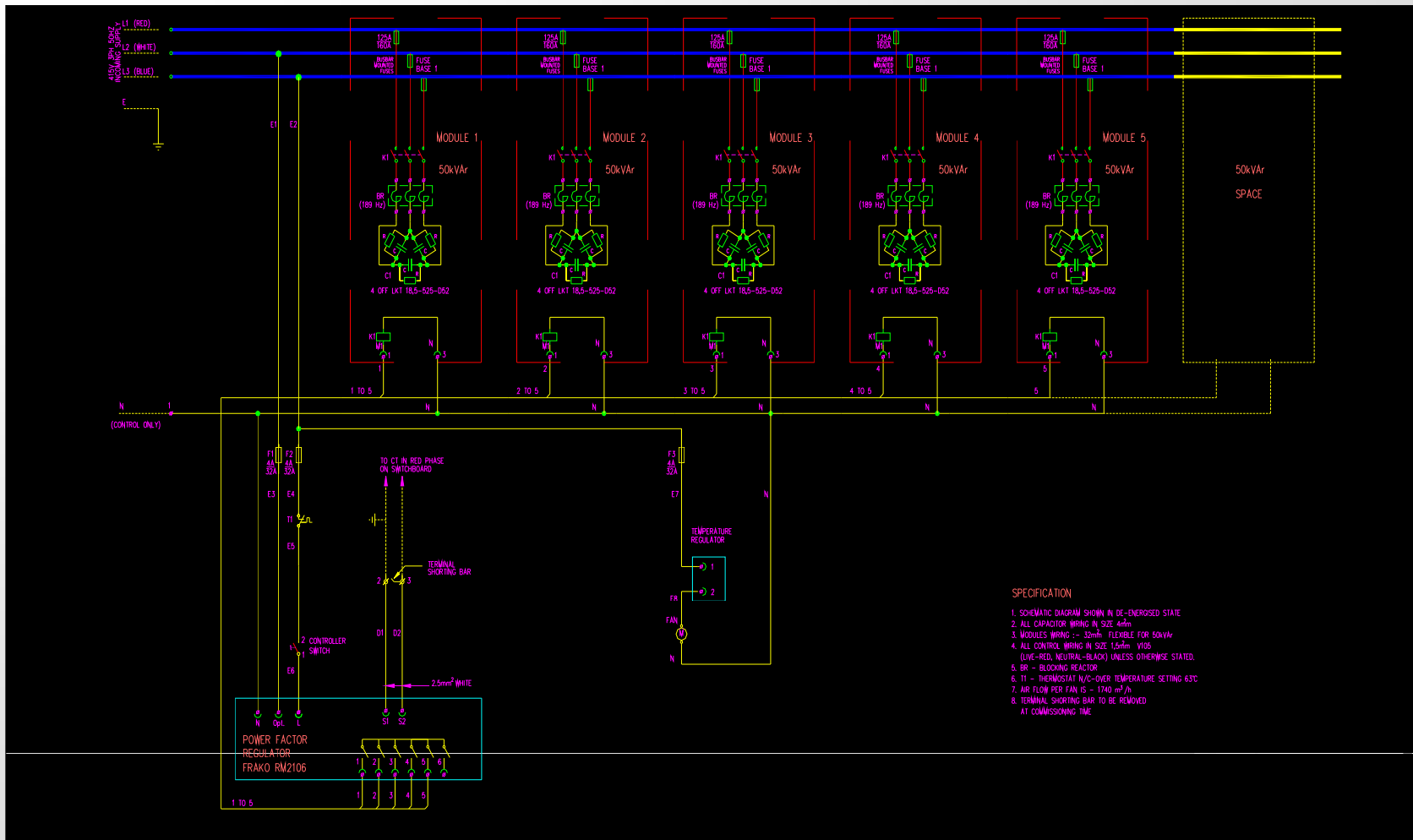
Motor Control Centre



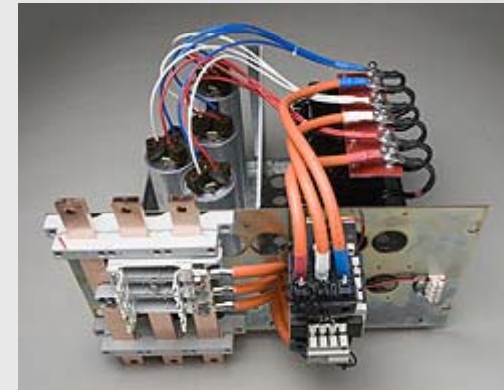
Motor Control Centre



Power Factor Correction Unit



Power Factor Correction Unit



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Power Factor Correction Unit

9.0 Maintenance

CAPTECH power factor correction system operates automatically and is designed to operate for a long time with regular preventative maintenance. To avoid reactive power penalty charges suddenly being incurred or the correction system being damaged by an undetected fault, we recommend that regular preventative maintenance to be carried out.

9.1 Alarm Signal

The reactive power control relay is provided with a built-in alarm contact (terminals a and b), which can be connected to an alarm system. If the set power factor is not achieved, a signal is given and the **Alarm** LED on the instrument itself lights up continuously. The operating manual for the control relay contains more information on the types of alarm and the programming of its set points.

9.2 Fuses

Low voltage, high breaking capacity fuses undergo an ageing process when carrying the high-switched currents associated with capacitors. They must be inspected at least once per year. We recommend replacing the fuse links after ten years at the latest.

9.3 Contactors

CAPTECH system uses contactors specially designed for capacitor switching only. Please ensure that only matching contactors are fitted when replacing.

The contacts of capacitor switching contactors have a particularly demanding duty. They are tested for 80,000 switching cycles and must be completely replaced once this number has been reached. If the power factor correction system has a control relay with a switching cycle counter, a separate message is given for each stage after 80,000 switching cycles (factory setting which can be reprogrammed) to inform the operator that contactor replacement is due.

The current counter readings can be accessed via the control relay. When capacitor stages are switched in manually, the number of switching cycles appears briefly in the display (multiply reading by 1000).

Wear and tear of the switching contacts has an adverse effect on the service life of the capacitors!

9.4 Discharge Resistors

The discharge resistors are fitted to the capacitor terminals for safety reasons in compliance with VDE (German Association of Electrical Engineers) and AS 2897 regulations. In addition to their safety function, they are also indispensable for problem-free operation of the system and must not, in any account, be removed. Attention must be paid to this point particularly when capacitors are replaced!

9.5 Capacitors

The capacitors must be checked at regular intervals for any mechanical changes. Any variation in capacitance or distortion by harmonics can be inferred from the operating currents measured. If any irregularities are detected, please contact Capacitor Technologies directly.

9.6 General

Please ensure that the system is kept clean at all times. During inspection, the system must be given a visual check by an electrician to verify its good working order, ie sound electrical contacts, no evidence of overheating, etc.

Components, bus-bar system and control circuitry connections should remain tight. However, carelessness or thermal expansion/contraction could result in improper connections. A resistive joint may thus occur. This is usually recognised by discolouration of cable insulation near the connectors, inability to get rated power where it had been obtained previously, or unstable operation of equipment. During periods of diagnosis for unusual troubles or annual shutdown maintenance, it is good to check connections.

Table 1 below is a guide in periodic preventative maintenance checks. Failure to provide proper maintenance may result in component failure and/or system breakdown.

	Before Start Up	Initial First Week	Every Six Months
Tighten Bolts & Screws	√	√	√
Cleaning Equipment			√

Table 1: Recommended minimum maintenance schedule



When working inside enclosure, disconnect and padlock off incoming power.



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WHEN TO MAINTAIN

The effect on business

Form of Construction

Location

Environment

Duty



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WHEN TO MAINTAIN

AS 2467 clauses 4.4.3, 4.4.4 & 4.4.5

Inspect – 12 months

Examine – 5 years

Overhaul – 15 years



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CONCLUSION



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Predictive maintenance

POWERLOGIC System Manager Demo

Time	Event	Module	Value
2000-01-01 00:00:00	Power On	100A	100
2000-01-01 00:00:00	Power On	200A	200
2000-01-01 00:00:00	Power On	300A	300
2000-01-01 00:00:00	Power On	400A	400
2000-01-01 00:00:00	Power On	500A	500
2000-01-01 00:00:00	Power On	600A	600
2000-01-01 00:00:00	Power On	700A	700
2000-01-01 00:00:00	Power On	800A	800
2000-01-01 00:00:00	Power On	900A	900
2000-01-01 00:00:00	Power On	1000A	1000
2000-01-01 00:00:00	Power On	1100A	1100
2000-01-01 00:00:00	Power On	1200A	1200
2000-01-01 00:00:00	Power On	1300A	1300
2000-01-01 00:00:00	Power On	1400A	1400
2000-01-01 00:00:00	Power On	1500A	1500
2000-01-01 00:00:00	Power On	1600A	1600
2000-01-01 00:00:00	Power On	1700A	1700
2000-01-01 00:00:00	Power On	1800A	1800
2000-01-01 00:00:00	Power On	1900A	1900
2000-01-01 00:00:00	Power On	2000A	2000

Predictive maintenance

Predictive maintenance, based on the recording and analysis of system parameters, is the means to detect drift from the initial state and significant trends. Using predictive maintenance, the customer can anticipate on the corrective action required to ensure equipment safety and continuity of service, and plan the action for the most convenient time.

To ensure the highest possible level of installation reliability and optimise the service life of equipment, it is advised to establish a maintenance plan. The plan indicates for each piece of equipment:

- the most suitable type of maintenance
- the recommended frequency of maintenance.

The plan is based on two criteria:

- the criticality of each device in the installation
- device operating conditions.

Criticality depends on the consequences of device failure in terms of the safety of life and property, production losses, the cost of repair and start-up, etc. An empirical estimate may be sufficient for simple cases, but it is recommended to undertake a reliability analysis of the installation for more complex architectures involving backup sources, transfer mechanisms, etc. Check with your Schneider Service Centre for more information.

The operating conditions reflect the environment in which the device is installed (relative humidity, heat, dust, etc.) and how the device is used (load, frequency of operation, quality of the supply current, etc.). These conditions are discussed in detail in this document, as well as the ensuing maintenance recommendations.

Consequently, for a given device, the recommended maintenance may vary substantially both in terms of the necessary operations and their frequency.

Example of Masterpact predictive maintenance

Monitoring and recording	Goal	Tool	Service offered
Number of operating cycles	Monitor manufacturer limits and determine the probable replacement date	Electronic counter with the communication module + MPS100 server	Remote monitoring by: ■ customer supervisor or ■ Serenity service ⁽¹⁾
Trip and alarm histories	Analyse the distribution-system phenomena that resulted in tripping or alarms caused by transient overloads, setting changes or a modification in the installation	Micrologic P/ H event log + MPS100 server	Remote monitoring by: ■ customer supervisor or ■ Serenity service ⁽¹⁾
Contact wear	Monitor (without dismantling) the arc chutes on the circuit breakers and plan their replacement	Micrologic P/ H event log + MPS100 server	Remote monitoring by: ■ customer supervisor or ■ Serenity service ⁽¹⁾
Percent load	Estimate as precisely as possible the probable service life of the device		Remote monitoring by: ■ customer supervisor or ■ Serenity service ⁽¹⁾
Pole opening and closing speed	Monitor any mechanical drift in devices and evaluate their condition	Prodiag tester	Remote monitoring by: ■ customer supervisor or ■ Serenity service ⁽¹⁾

⁽¹⁾ Serenity is a Schneider Electric service providing installation diagnostics and analysis of distribution systems.

For more information on the possibilities offered by predictive maintenance, contact your Schneider after-sales support department.



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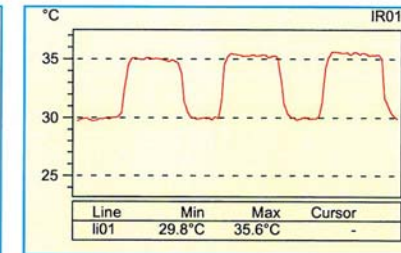
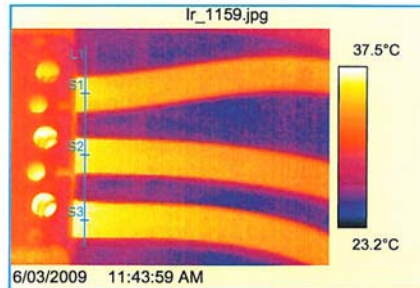


Specialist Companies

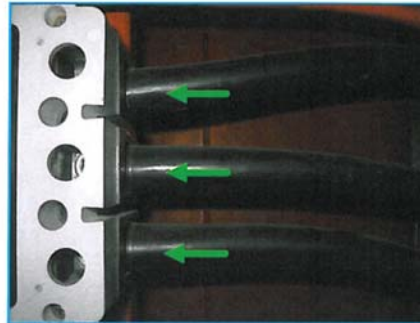
SCANNING SCHEDULE

[illegible]

Equipment Type: MAIN SWITCHBOARD:- MAIN SWITCH No.2.



IR information	Value
Date of creation	6/03/2009
Time of creation	11:43:59 AM
File name	Ir_1159.jpg
Object parameter	Value
Ambient temperature	24.0°C
Label	Value
IR : max	36.7°C
IR : min	28.8°C
S1	35.1°C
S2	35.3°C
S3	35.6°C
L1 : max	35.6°C
L1 : min	29.8°C
L1 : avg	32.9°C

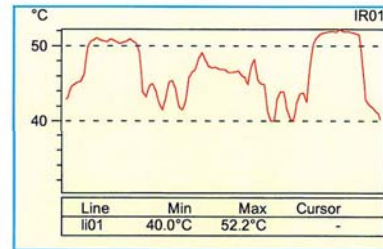
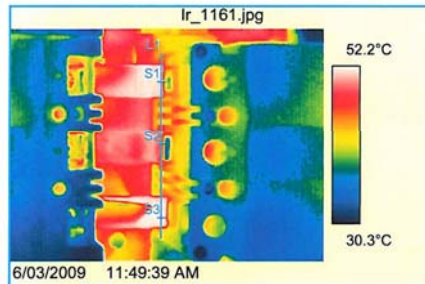


COMMENTS

At the time of scanning all temperatures were within equipment rating. No faults were detected and no further action is required.

Specialist Companies

Equipment Type: MAIN SWITCHBOARD, LOCAL D/B ISOLATORS:- ISOLATOR D/B No.4.



IR information		Value
Date of creation		6/03/2009
Time of creation		11:49:39 AM
File name		Ir_1161.jpg
Object parameter		Value
Ambient temperature		24.0°C
Label		Value
IR : max		52.5°C
IR : min		29.7°C
S1		50.8°C
S2		46.9°C
S3		51.9°C
L1 : max		52.2°C
L1 : min		40.0°C
L1 : avg		46.7°C

COMMENTS

A high resistance joint was found on the line side C phase termination to Isolator Distribution Board No.4. Suggest repairs be carried out as soon as possible.
Isolator Rating = 160Amps.
Load Current: A Phase = 58Amps, B Phase = 71Amps, C Phase = 64Amps.

Equipment Type: MAIN SWITCHBOARD, LOCAL D/B ISOLATORS:- BUSBAR CHASSIS.

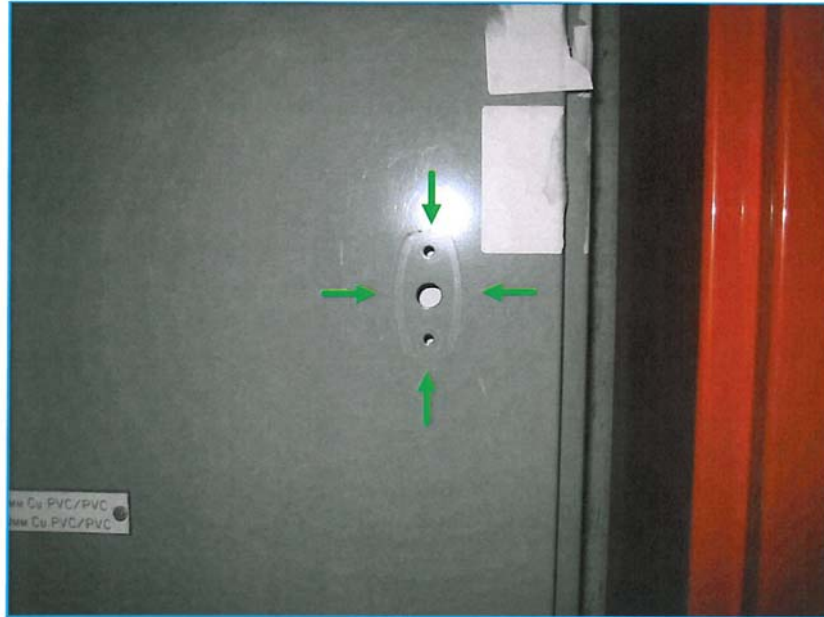


COMMENTS

The busbar chassis insulation was found to be cracked on all three phases to the Local Distribution Board Isolators Section of the Main Switchboard. Suggest further investigation and repairs to be carried out if deemed necessary.

Specialist Companies

Equipment Type: AIR CONDITIONING DISTRIBUTION BOARD:- DOOR HANDLE.



COMMENTS

The door handle to Air Conditioning Distribution Board was found to be missing.
Suggest replacement handle be installed as soon as possible.



Specialist Companies

DATE: SHEET No: of		P/O No: ABN: P/O DATE: JOB No:		EQUIPMENT: TYPE: RATING:		No.	
CLIENT NAME & ADDRESS:				CONTACT: TEL No:			
VISUALLY CHECKED:				MEASUREMENTS:			
NAME		CHECKED	COMMENT	SUPPLY VOLTAGE (V)			
FUSES				R - N		W - N B - N	
CAPACITORS				R - W		W - B B - R	
RIPPLE REJECTOR COILS							
BLOCKING REACTORS							
DISCOLORATION OF BUSBARS							
DISCOLORATION OF WIRES							
TIGHTNESS:				STAGE	INSULATION RESISTANCE of CONDUCTORS	RESISTANCE of EARTHING SYSTEM	CAPACITANCE
BOLTS		CHECKED	COMMENT	1			
CONTACTOR				2			
FUSE BASES				3			
BLOCKING REACTORS				4			
CONTROL CIRCUIT				5			
OTHERS:				6			
OPERATION:				7			
NAME		CHECKED	COMMENT	8			
FAN							
CONTROLLER		AUTOMATIC ON					
		MANUAL ON					
ALARM							
CLEANING:							
VACUUMED INSIDE UNIT		YES <input type="checkbox"/> NO <input type="checkbox"/>					
Air Filter Exchanged/Cleaned: Damage: YES NO				MATERIAL:			
Repair Carried Out:				QTY	PART No.	DESCRIPTION	PRICE
Material Used:							
Unfinished Work:							
Unit has been found in satisfactory condition and good working order: YES NO							
Recommended Action:							
Recommended Next Maintenance:							
ENGINEERS NAME: SIGNATURE:				TOTAL:			
I certify that subject to the exception listed above the work has been carried out satisfactorily.				Name: Signature:			

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Design



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Manufacturer's Literature



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3rd PLACE



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2nd PLACE



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WINNER



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