

DOMAIN MASTERPLAN**ELECTRICAL SERVICES**

Prepared by

Denis Blackett and Associates Pty Ltd
Suite G 8.16
100 Miller St.,
NORTH SYDNEY 2060
Phone: 02 9922 6511
Fax: 02 9959 5153

May 2000

EXECUTIVE SUMMARY

The Electrical Services within the Domain Precincts basically have been reviewed in two distinct areas, these are :-

- a) Lighting Systems
- and b) Event Electrical Provisions

LIGHTING SYSTEMS

The lighting systems are generally all working as originally installed. A small number of fittings need replacement parts and routine maintenance check. Most light fittings need cleaning. A non-invasive inspection reveals that the overall lighting installation complies with AS 3000 Wiring Rules.

There are four (4) Light Standard used in the Domain Area with the Pierlite ORBIT fitting (refer photographs) being the most predominant.

In most instances the installed lighting for pathways, roadways and stairways does not comply with the new Public Space Pedestrian Lighting Code, AS 1158 – “Road Lighting; Part 3.1: Pedestrian Area (Category P) lighting – Performance and installation design requirements”. This new code, first published in 1999, introduces for the first time lighting in public spaces and its relationship to the the reduction of risk of crime at night. The only open areas found in compliance were those pathways lit by the Thorn BOULEVARD fitting (refer photographs) within Phillip and Crescent Precincts.

To upgrade the existing pathway, roadway and stairway lighting to meet the lighting criteria set in AS 1158 will require the adaptation of one or all of the following remedial actions :-

1. Add new equivalent Lighting Standards to fit between existing Standards.
2. Replace the Lighting Standard
3. Replace the Luminaire part of the Lighting Standard

This will require the substantial expenditure of funds. Further, the majority of Lighting Standards are about 20 years old. The PWD “Building Energy Manual” states that the economic life of the Luminaire part of the Lighting Standard is 25 years maximum and the steel pole is 40 years maximum.

We recommend the establishment of a coherent cost effective lighting regime for the Domain. This would require further extensive study and report that included the needs of all interested parties. A lighting strategy would be developed that establishes the lighting fitting to be used, identifies extent of areas to be lit, and identifies the appropriate performance category within the code or other agreed standard , such as the City of Sydney Lighting Standard, for each area to be lit.

In the short term, a cleaning and replacement program should be formulated to allow for the lighting systems operate to the best of its capacity and be upgraded as practicable to comply with the new standard AS 1158.

A budget of \$ 2m* is suggested for the overall Lighting Standard upgrade.

A reduced scheme that only allows for the critical pathways and stairways from the NSW State Library to Woolloomooloo and the Domain Parking Station is estimated to cost \$ 100,000* if existing fittings are augmented and \$ 200,000* if all new fittings are to be installed.

Lighting of all toilet facilities were inspected and found to be providing satisfactory service.
Lighting of new toilets in Yurong Precinct could be solar powered at an estimated cost of \$ 10,000*.
Some external stairways remain unlit. This safety issue needs to be quickly addressed.
The pathways in the Tarpeian Precinct are generally poorly lit.

EVENT ELECTRICAL PROVISIONS

A non-invasive inspection reveals that the overall event electrical installations comply with AS 3000 Wiring Rules.

To overhaul the existing power cubicle, add some conduit and kiosk power services in the Phillip Precinct we recommend a budget of \$ 40,000*.

To move the Stage to the alternative location in the Phillip Precinct we recommend the installation of a new kiosk substation and a budget of \$ 200,000*.

To provide an alternative power cubicle in the Lower North Yurong grassed area we recommend a budget of \$ 25,000*.

To provide a substation for the Yurong Precinct we recommend a budget of \$ 120,000*. This substation is only necessary if any future significant electrical loads are to be added in this area.

The most difficult area to provide for medium to large electrical loads as found in Event Staging is the Tarpeian Precinct mainly because adjacent developments have eroded any available spare capacity, pointing to a very costly substation installation to meet these possible needs

Re-locatable Low Voltage Power Cubicles to replace existing fixed cubicles are recommended for Phillip and Yurong Precincts to reduce visual scarring in these areas and protect the cubicles from vandals and weather by storing them safely between stage events. Estimated Cost of this work is \$ 50,000*.

MISCELLANEOUS

Energy Australia do not have any plans to de-commission or relinquish all or part of their City East Zone Substation Located at Lincoln Cres. Woolloomooloo.

* All costs current as of May 2000 and do not include for GST Costs.

DOMAIN MASTERPLAN**ELECTRICAL SERVICES**

Prepared by

Denis Blackett and Associates Pty Ltd
Suite G 8.16
100 Miller St.,
NORTH SYDNEY 2060
Phone: 02 9922 6511
Fax: 02 9959 5153

May 2000

AIM:

1. To analyse the extent of the electrical services
2. To provide an inventory of light fitting types
3. To analyse lighting levels for paths, streets and toilets
4. To analyse the compliance of the electrical services with relevant Australian Standards
5. To analyse the methodology of providing revised power supply equipment for relocated Stage, Kiosks and Speaker Towers in the Phillip Precinct.
6. To analyse the methodology of providing an alternative power supply facility in the Northern Section of the Yurong Precinct Concert Area.
7. To analyse the availability of power supply for the staging of events in the Tarpeian Precinct.

FINDINGS AND RECOMMENDATIONS:

1. Extent of Electrical Services

Domain

The location of electrical services is shown on Inventory Plans supporting Reports Volume 3.

Phillip Precinct

The major electrical services within the precinct comprise lighting standards, power supplies, 3 phase and single phase for Phillip Precinct for Stage and Kiosks. Also light fittings to toilets and change rooms.

These services are generally in good condition.

An 800A, 415V, 3 phase Low Voltage Supply to existing Phillip Precinct Stage Electrical Service Cubicle is run underground from an Energy Australia substation in the Register General's building, corner of Prince Albert Road and Hospital Roads.

The Pavilion is fed via a Low Voltage 3 Phase service from the existing Art Gallery substation.

Yurong Precinct

A 60A, 415V, 3 phase supply is served from the Toilet Block in the southern sector of Yurong Precinct to a pole mounted power supply box in the Yurong South Event location.

Tarpeian Precinct

No Event power is available in this area. The cost to establish permanent Event Power in this area is significant and could be many hundreds of thousands of dollars depending on specific requirements.

Lighting Generally

Some light fittings and poles show signs of vandalism damage. Some fittings are not working, requiring electrical maintenance.

A large number of the light fittings are 20 years old or older. These fittings will in the next decade reach the end of their economic life.

The NSW Public Works Building Energy Manual defines the maximum economic life for external street lights as 25 years and external steel poles as 40 years.

Most light fittings need cleaning to provide design illuminance.

City East Zone Substation

The City East Zone Substation is located at the Southern End of the Woolloomooloo Precinct. Energy Australia have no plans to de-commission this valuable electrical asset. In our opinion none of the existing land occupied by Energy Australia is supplementary to their needs.

2. Inventory of Lighting Types

There are four major Light Standards used in the Domain Precinct

TYPE 'A' PIERLITE Orbit Cat No. OPT 175 MV with 175 W mercury vapour reflector lamp mounted on a 3.5 m. dual diameter painted steel pole.

These are the predominant fitting and are located in the Philip, Crescent, Art Gallery, Woolloomooloo and Yurong Precincts.



TYPE 'B' THORN Boulevard Cast Pole Lanterns 80W mercury vapour lamp in a glass refractor assembly mounted on a 3.5m. cast pole.

These fittings are located in the Phillip Precinct Main Avenue, Crescent Precinct pathways and at Mrs. Macquaries Point.



TYPE 'C' BEGA Type 8086 with 125W CDM single ended metal halide lamp on a 4m dual diameter steel painted pole. These fittings were the most recently installed Light Standards.

These fittings are located over the Cahill Expressway on the land bridge on the north side of the Art Gallery.



TYPE'D' SYLVANIA Macquarie 70W double ended metal halide lamp on dual diameter painted poles.

These fittings are located along paths and only in the Macquarie and Tarpeian Precincts.



There are also minor fittings in selected areas :-

These fittings are :-

- a) 1 x 18W brick lights, specially built, located at the Palace Garden Gate in the Macquarie Precinct.
- b) Post Top Opal Spheres, 80W mercury vapour lamp, on 3m high painted steel poles.
These fittings are located in and adjacent to the Andrew 'Boy' Charlton Swimming Pool.
- c) 125W mercury vapour inground uplights.
These fittings are installed to provide tree lighting in selected sections of Phillip and Tarpeian Precincts.
- d) 2 x 18W fluorescent fittings on wooden poles.
These fittings are located on the staircase structure to the Domain Parking Station.

3. Lighting Analysis

Due to the nature of lighting, low levels of illumination, dirt depreciation, lamp depreciation and spill light from external factors, we consider that lighting measurements would not be the most accurate method of establishing accurate lighting levels.

A calculation method has been adopted and compared to criteria set in Australian Standard AS/NZS 1158.3.1:1999 Road Lighting – Pedestrian Area (Category P) lighting – Performance and Installation Design Requirements.

4. Compliance with Australian Standards

As can best be determined from a non-invasive inspection, it appears that the electrical equipment has been installed in compliance with the electrical requirements of Australian Standards.

Lighting Levels

The new Australian Standard AS / NZS 1158.3.1:1999 requires planners to make subjective choices to establish design criteria for pedestrian precincts such as the Domain.

The design choices are generally :-

- a) The type of pathway lighting system
- Pedestrian or cycle oriented pathways e.g. footpaths, including those along local roads and arterial roads, walkways, lanes, park paths, cycleways.

We have selected Lighting Category **P2** for pathway lighting, as the most consistent match, with the following Code References :-

- Pedestrian/cycle traffic only
- Medium Risk of Crime

- b) The type of road lighting system
- Main Arterial Road systems
 - Collector Roads, Arterial Roads; Category P3 and P4
 - Local Roads or streets, Category P3, **P4** and P5
 - Common Areas, forecourts of cluster housing: P3 and P4

We have selected Lighting Category **P4** for roadway lighting, as the most consistent match, with the following Code References :-

- Local roads or streets used primarily for access to abutting properties, including residential properties.
- Low Pedestrian/cycle activity
- Low Risk of Crime
- No need for the lighting to enhance the prestige of the area.

- c) Type of Connecting element lighting
- Comprises steps and stairways, ramps, Footbridges, Pedestrian ways

Lighting Category **P9** is considered most appropriate for Connecting Elements eg stairs

TABLE 1 - Pathway Lighting Category P2

Fitting Type	Lighting Technical Parameters	Design Requirements	Calculated or as installed	Comments
ORBIT	Maintained Horizontal Av. Illum. (Eh maint.)	3.5 lux	11 lux	Sub-Standard
Type A	Maintained Horizontal Illum. (Eh maint.)	0.7 lux	0.8 lux	Costly Upgrade
	Maintained Horizontal Illum. Uniform (Up maint.)	10	2	
	Maintained Vertical Illum. (Ev maint.)	0.7 lux	1.4 lux	
	Spacing of Fittings	25 m	35 m	
	Upward Light Ratio UWLR	12%	7%	
BOULEVARD	Maintained Horizontal Av. Illum. (Eh maint.)	3.5 lux	3.5 lux	Satisfactory
Type B	Maintained Horizontal Illum. (Eh maint.)	0.7 lux	0.7 lux	
	Maintained Horizontal Illum. Uniform (Up maint.)	10	10	
	Maintained Vertical Illum. (Ev maint.)	0.7 lux	0.7 lux	
	Spacing of Fittings	20 m	20 m	
	Upward Light Ratio UWLR	25%	10.8%	
BEGA	Maintained Horizontal Av. Illum. (Eh maint.)	3.5 lux	3.5 lux	Sub-Standard
Type C	Maintained Horizontal Illum. (Eh maint.)	0.7 lux	0.7 lux	Possible Luminaire
	Maintained Horizontal Illum. Uniform (Up maint.)	10	10	Change
	Maintained Vertical Illum. (Ev maint.)	0.7 lux	0.7 lux	Optic
	Spacing of Fittings	9 m	20 m	Change
	Upward Light Ratio UWLR	12%	0.5%	
MACQUARIE	Maintained Horizontal Av. Illum. (Eh maint.)	3.5 lux	3.5 lux	Sub-Standard
Type D	Maintained Horizontal Illum. (Eh maint.)	0.7 lux	0.7 lux	Costly

Maintained Horizontal Illum. Uniform (Up maint.)	10	10	Upgrade
Maintained Vertical Illum. (Ev maint.)	0.7 lux	0.7 lux	
Spacing of Fittings	6 m	18 m	
Upward Light Ratio UWLR	12%	17.5%	

TABLE 2 - Roadway Lighting Category P4

Fitting Type	Lighting Technical Parameters	Design Requirements	Calculated or as installed	Comments
ORBIT Type A	Maintained Horizontal Illum. (Eh maint.)	0.14 lux	0.175 lux	Possible
	Spacing of Fittings	28m.	25m.	Luminaire
	Maintained Horizontal Illum (Eh maint.)	0.14 lux	0.084 lux	Upgrade
	Spacing of Fittings	28m.	35m.	

Summary of recommendations for the above :

- i) ORBIT fitting
Recommend replacing the existing fitting with a higher performance fitting or doubling the number to produce the horizontal and vertical levels designed. This will produce P2 footpath lighting design complying with AS 1158.
A replacement fitting should be investigated to meet code requirements for P4 roadway lighting without altering the spacing of the fittings.
- ii) BOULEVARD fitting
These fittings produce code requirement in their current installed configuration.
- ii) BEGA fitting
Recommend replacing the light fitting optics to produce P2 footpath lighting design complying with AS1158.
- iii) MACQUARIE fitting
Recommend tripling the number of these fittings or replacing these fittings with a higher performance fitting to produce horizontal and vertical light levels as indicated in the standard AS 1158.

5. Phillip Precinct Concerts – Power Requirements

The electrical maximum demand for a concert has been assessed as 1000A per phase.

This is currently produced by the following :

(a) Mains Power (Energy Australia)	800A/ph.
(b) Stand By Set	<u>200A/ph.</u>
Total	1000A/ph.

If the existing Stage location for concerts is retained then only the following actions are recommended :

1. Refurbish the existing Low Voltage (415/240V) Cubicle.
2. Hire up to a 400 KVA stand by Generator Set for each performance.
3. Place an additional Low Voltage (415/240V) service to Cahill Road area.
4. Add and improve underground conduit services for Sound Relay Towers.

Should the stage be moved to the alternative location the following new Electrical Services Infrastructure will be required :

1. New 1000 KVA substation
2. New High Voltage (11KV) cable service from Land Titles Office or Art Gallery existing substations
3. New Low Voltage (415/240V) Cubicle for Stage Area
4. Low Voltage service to four (4) new Toilet Blocks
5. Bollard Type Low Voltage Services for Kiosks, Transportable Toilets etc.

6. Conduits to 7-8 Sound Relay Towers

For this alternative no additional Generator supplies will be needed.

Cost Estimates for each alternative are :

	Works Cost Estimate
1. Retain Current Stage Position	\$40,000*
2. Use Alternative 1 Stage Position	\$200,000*

7. Yurong Precinct Events – Power Requirements

The electrical demand has been assessed as 200A per phase.

This is produced by the following :

(a) Mains Power (Toilet Block Yurong)	60A/ph.
(b) Stand By Set	<u>140A/ph.</u>
Total :	200A/ph.

Should the plan to develop an alternative supply to the grassed area immediately north of the current event area be implemented the following works are recommended :

1. New Low Voltage (415/240V) Cubicle
2. Additional Conduits for food and other services

Cost Estimate for the above two items : \$ 25,000*

Should the need to supply all power from a permanent service be required then a substation would need to be established in the new vicinity of the events area involving the following :

1. New 200 KVA substation
2. New High Voltage (11KV) cable service from Royal Botanic Gardens Herbarium Substation

Cost Estimate for HV Service : \$ 120,000*

The provision of H.V. services in the Phillip and Yurong Precincts will have further benefits other than simply providing adequate power for special events. These additional benefits include :

- (a) Boosting of Voltage generally in the Domain. This will result in the reduction of cabling sizes used in the general area of service, and would provide significant cost savings to future upgrade works.
- (b) Boosting Power Levels. This would allow for the addition of further electrical services in the area e.g.
 - More Lighting; if required
 - More General Power; if required
 - Water Pumping for irrigation to additional and new areas
 - Food Kiosks

We recommend also that portable Low Voltage Distribution Cubicles be considered for the Phillip and Yurong Precincts that are simply bolted in place and plugged into a major power supply when needed. Between events these Cubicles could be stored in an appropriate shed.

8. Tarpeian Precinct

No Event power is available in this area. Power would need to be sourced from across Macquarie St.. Most likely a substation may have to be established in this Precinct. There is no substation in Government House.

The cost to establish permanent Event Power in this area is significant and could be many hundreds of thousands of dollars depending on specific requirements.

CONCLUSION :LIGHTING

We recommend that attention be brought to the existing Domain lighting installation to achieve wherever possible the intent of the new Pedestrian Area Lighting Standard AS/NZS 1158.3.1:1999. This standard is the first in Australia to address directly the link between lighting and crime in public spaces.

In the main this will mean replacement of some light fixtures with higher performance types or up to doubling and in some cases tripling the main Lighting Standards of Domain pathways/roadways and lighting of all stairways and ramps. Some open areas where pathways are sparse should also be addressed where it is considered that pedestrian traffic will cross open areas or where normal security monitoring (visual) would be enhanced by such public area lights.

In this regard we stress that a well designed solution, involving all parties, is critical to avoid the night time visual scarring of this very prominent landscape by a glary, overlit and controversial design.

The cost of uprating the existing underlit pathways with equal fittings to those existing is estimated at approximately \$1M, however we feel that the variables are so great that an agreed design concept will be needed to finalise a budget.

Also we strongly recommend that, as a large number of the existing light fittings are reaching their 30 year economic life span, that a plan be formulated for their replacement. This replacement is also estimated to cost approximately \$ 1M*, bringing our estimated lighting upgrade budget to \$ 2M*.

If only critical pathways in Phillip, Crescent and Woolloomoolloo Precincts are selected for security upgrade to the P2 level requirements set down in AS 1158, we recommend a budget of \$ 100,000* for the upgrading and augmentation of existing fittings and \$ 200,000* for the installation of a new lighting system for the selected pathways.

We suggest that the Lighting Standard replacement/augmentation plan be based on a 30 year turn around and soundly formulated using a well grounded aesthetic and technical approach that includes as few fitting types as possible. In this regard, as the new Australian Standard AS 1158 was only published in 1999 for the first time, selection of fittings in the past was not necessarily related to crime activities in public spaces. We recommend that a new study should be initiated to select a fitting, or fittings, that meets all the old design criteria as well as the new AS 1158 requirements. This study would also involve a thorough consultative process to establish public lighting/crime relationships for all areas of the Domain.

EVENTS

PHILLIP PRECINCT

Should the existing stage location be retained, then we recommend that the power cubicle be refurbished and additional power bollards be established adjacent to the Cahill Expressway at an estimated cost of \$40,000*.

Should the Alternative 1 location be adopted, a new substation will be required, as will a new location for Kiosk power and Sound Relay Towers at an estimated electrical cost of \$200,000*.

YURONG PRECINCT (Fleet Steps)

To provide an alternative electrical cubicle for events in the Lower Northern Yurong grassed area, the estimated additional electrical costs are \$25,000*.

To provide a new substation supply into the Yurong Precinct, the estimated additional electrical costs are \$120,000*.

To provide a solar lighting system to a new toilet block at Mrs. Macquarie's Point, the estimated additional electrical costs are \$ 10,000*.

TARPEIAN PRECINCT

To provide a supply for Events in the Tarpeian Precinct is difficult and costly. The degree of difficulty will depend on the size of supply required and location of Stage

GENERALLY

Substations are recommended to be installed in the Phillip and Yurong Precincts to boost voltages and power availability in the relative remote areas of the Domain.

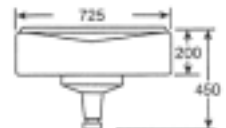
Re-locatable Low Voltage Power Cubicles to replace existing fixed cubicles are recommended for Phillip and Yurong Precincts to reduce visual scarring in these areas and protect the cubicles from vandals and weather by storing them safely between stage events. Estimated Cost of this work is \$ 50,000*.

* All costs current as of May 2000 and do not include for GST Costs.

LIGHTING TYPES

PIERLITE®

ORBIT



Concise lines with special low brightness canopy provide an elegant, enduring shape. Utilising a hidden light source, the emphasis is on controlled illumination without sacrificing performance.

FEATURES

- Low brightness optical control
- One piece high-impact acrylic enclosures
- Polished high grade aluminium reflector-canopy
- Die-cast aluminium fitter finished in matt black polyester powdercoat to suit 100mm O.D. water pipe
- IP43 rating

ORDERING DATA

Cat No.	Lamp
OPT125MV	125W mercury vapour
OPT175MV	175W mercury vapour
OPT250MV	250W mercury vapour
OPT150HPS	150W high pressure sodium
OPT250HPS	250W high pressure sodium

NOMINATE COLOUR

Standard Colour: black.
Other colours available to order.
Please nominate Dulux powder coat name and reference number.

Supplied less lamps

Note: 250W HPS version has tray mounted gear for remote mounting

Macquarie Series

DESCRIPTION

The Macquarie Series is a sophisticated and elegant low brightness lighting system featuring light stabilised acrylic 600mm seamless spheres with a crystal clear finish.

Lamp flux is focused by a reflector positioned below the light centre in the fixture base onto an upper convex reflector fitted to the upper inside surface of the sphere, which in turn directs the light into a down focused radial beam providing symmetrical illumination around the fixture. Where vandal proofing requirements exceed that of light stability, a polycarbonate sphere is available.

These fixtures present the designer with a unique opportunity to provide an attractive alternative style, producing functional lighting. As shown below, a variety of light sources may be selected to suit particular applications.

Base mounted HPF, 240V control gear is standard. Pole top mounted available as option. Refer control gear section for dimensions.

APPLICATIONS

Parks, Mall, Walkways and Passive Recreation Areas.

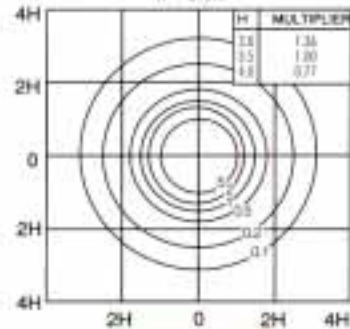


65

Architectural - Ambience

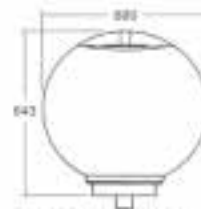
PERFORMANCE DATA

Isolux Diagram for Macquarie 600 100MA
H = 3.5m



PHYSICAL DATA

ALL DIMENSIONS IN MM



TO FIT POLE SPIGOT 76.0 O.D.

PROJECTED AREA	0.30m ²		
PACKAGING DIMENSIONS	L	W	D
Sphere (2)	1200	600	600
Base	290	290	220

DEGREE OF PROTECTION IP 54

ORDERING DATA

CAT. NO.	LAMP	MASS
MACQUARIE (REMOTE CONTROL GEAR)		
Mercury Vapour		
600-80MF	15LEW80	6.4kg
High Pressure Sodium		
600-70HPS	SH70/CO/1	6.4kg
Metal Halide		
600-70MH	15S1/170	6.4kg
600-100MA*	10T00/C/U	6.4kg

- Options:**
1. Pole top mounted control gear.
 2. * 100MA available with pole top mounted control gear only.
 3. For control equipment suitable for international supply voltages 220V - 230V, please specify.

BEGA



Pole-top luminaires for discharge lamps

with symmetrical or asymmetrical light distribution
 Die cast aluminium, aluminium and stainless steel
 Safety glass - Protection class IP 44 (L)
 Reflector made of pure anodized aluminium
 Colour black - Also available in white, denoted by **W** after the article number

The luminaires are designed for the following pole heights:

8081 - 8082 - 8180 - 8181 - for pole heights 4000 - 5000 mm
 Pole top ø 76 mm - Insert depth 60 mm

Matching BEGA luminaire poles:
 Cylindrical aluminium poles
 Colour black or white
 742 - 743 - 744 - Pole with arch section - Group 32
 705 - Pole with base plate - Group 12

8085 - 8086 - for pole heights 8000 - 9000 mm
 Pole top ø 76 mm - Insert depth 100 mm

Matching BEGA luminaire poles:
 Tapered poles made of galvanized steel
 835 - 839 - Poles with anchorage section - Group 62
 Description of the poles on pages 134 - 136



				A	B
8081	1 HMC	50/125 W	symmetrical	710	360
8082	1 HMC	50/125 W	asymmetrical	710	360
8180	1 HSE-E	50/70 W	symmetrical	710	360
8181	1 HSE-E	50/70 W	asymmetrical	1000	525
8085	1 HMC	400 W	symmetrical	1000	525
8086	1 HSE	350 W	symmetrical	1000	525