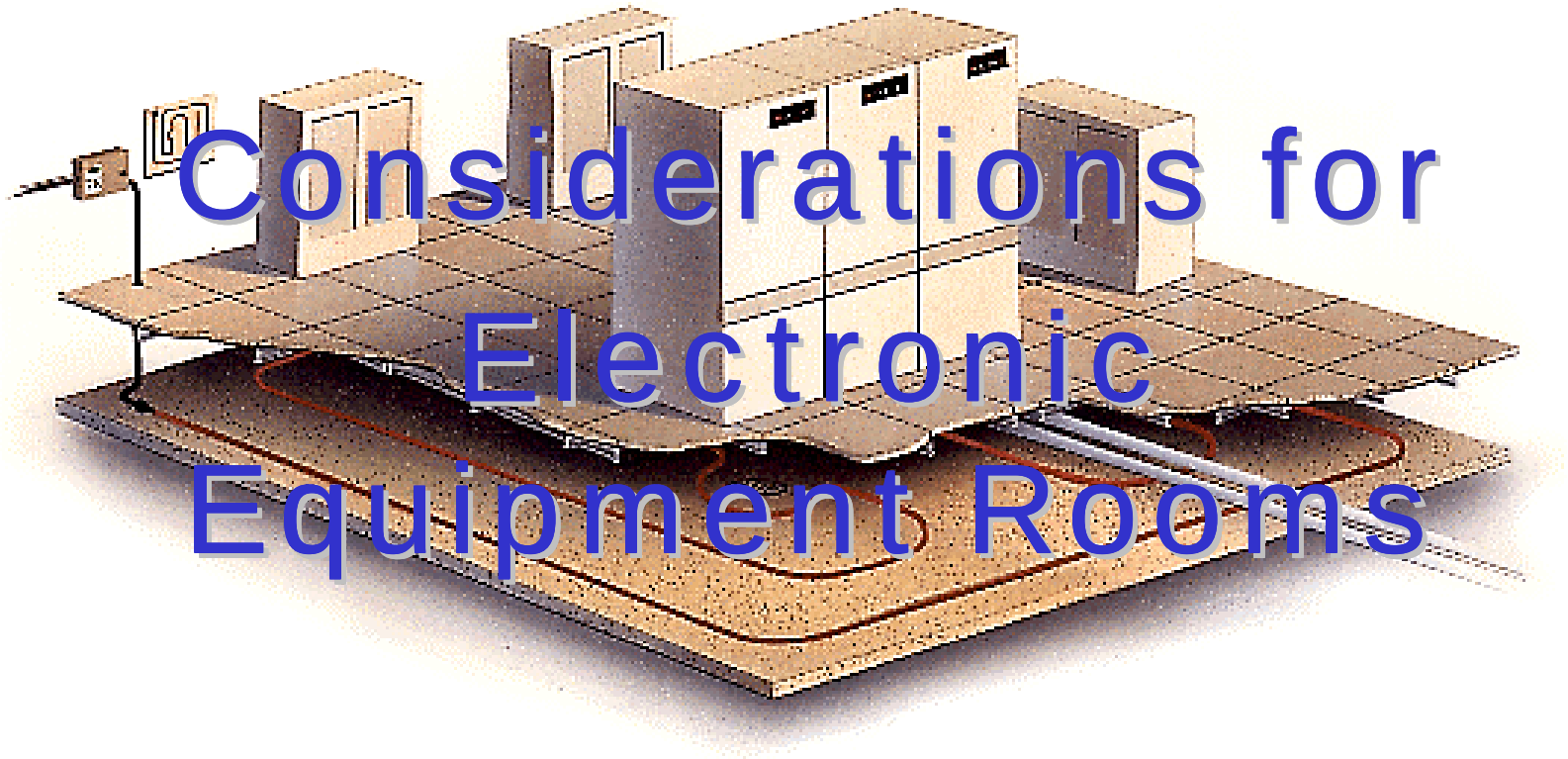


Considerations for Electronic Equipment Rooms

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Considerations for Electronic Equipment Rooms

- Normal Load Density
- Preferable for the room to be in an interior zone.
- Isolation from base building air conditioning.
- Vapour sealing of room

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Considerations for Electronic Equipment Rooms

- Normal Load Density
  - Building Fabric Load
  - Equipment Load
- 0.35 ~ 0.85 kW/m^2
  - 0.1 ~ 0.2 kW/m^2
  - 0.15 ~ 0.65 kW/m^2

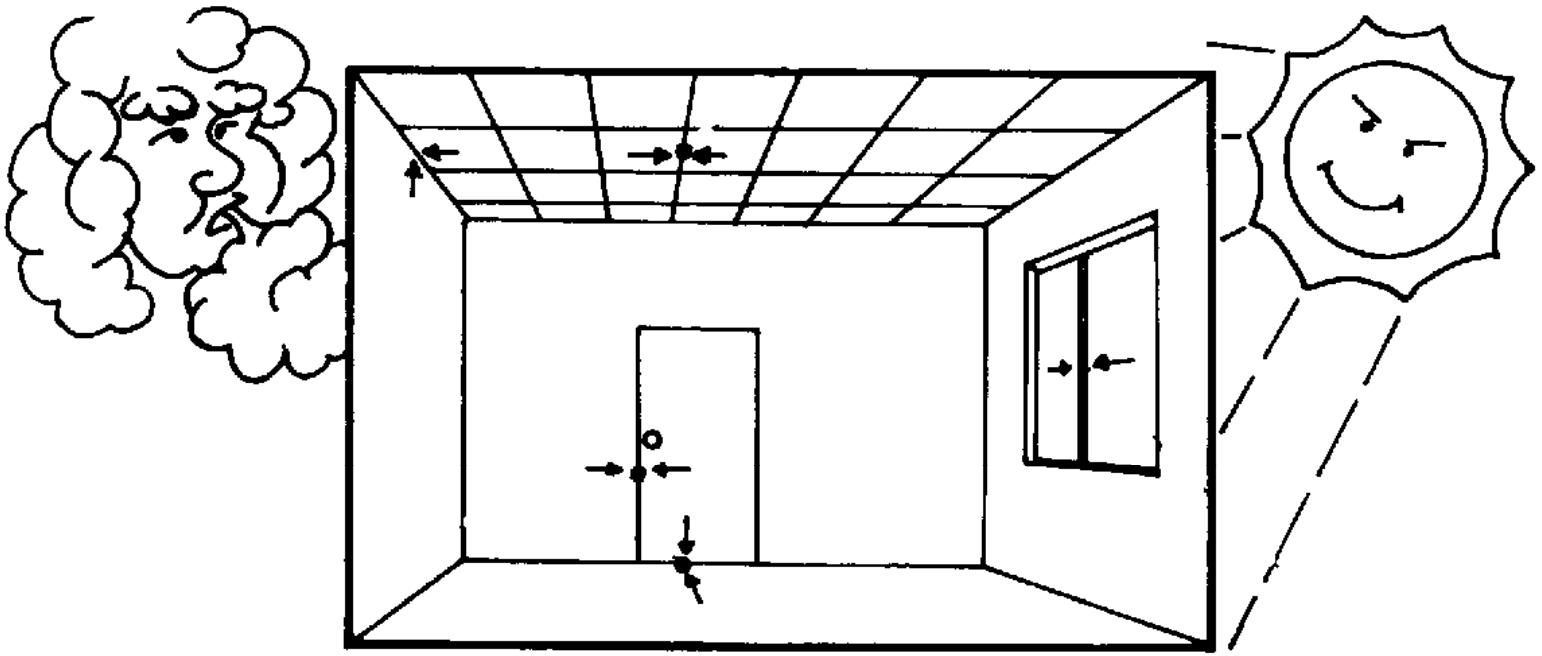
In base building load **sensible 75%** approx latent approx 25% - the sensible load **0.15 kW/m^2** equipment load is **all sensible**.

Hence

"SHF" is then **90 ~ 98%**

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Preferable for the room to be in an internal zone



- Isolation from base building air conditioning.
  Vapour sealing of room.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Vapour sealing of room

- Walls slab to slab
- Doors well-fitted with seals and open out.
- If on an exterior zone, seal window frames.
- Seal all cable and other penetrations

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Vapour sealing of room

A 6m x 10m room with and 2.7m in height

= 162m^3 which is ~190kg of air.

@24ºC 60%RH = 11.3 g/kg or 2.15 kg

@24ºC 50%RH = 9.3 g/kg or 1.77 kg

@24ºC 40%RH = 7.5 g/kg or 1.42 kg

Differential = **3.8 g/kg** or 722 grams of moisture

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Why vapour seal a room

If a 5kW humidifier runs 25% of the time - this is 2,190 hours/annum and at 14c/kWh

= $1,500/annum.

Add additional maintenance to this (replacing consumable items) and it represents over $2,000 additional costs per annum

Advantage: improved room gradients

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Small Rooms

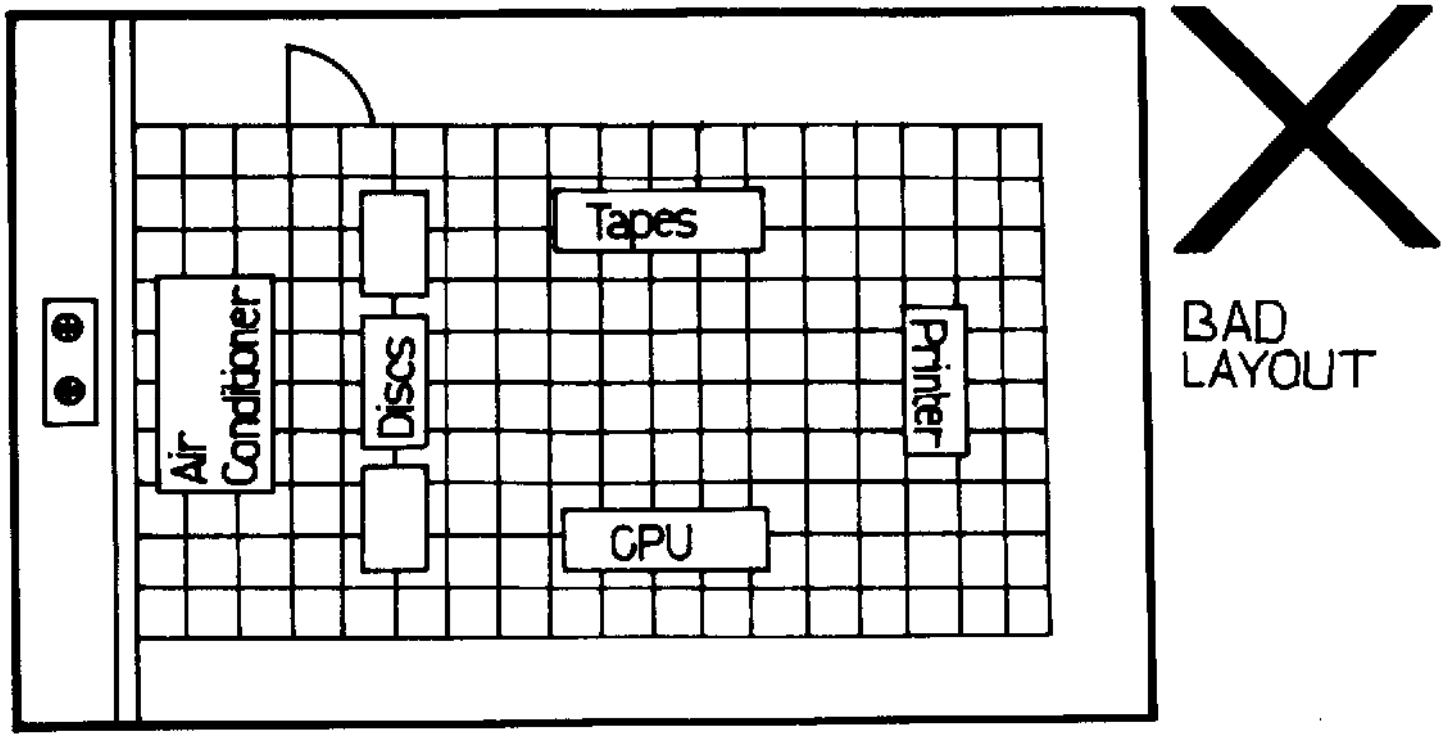
- Small rooms are more difficult to control than larger, multiple unit, rooms.
  - *Because the room has all the constraints (doors, windows, people movement, etc.) of large rooms.*
  - Small rooms have less capacity to humidify or dehumidify.

A 5 kW unit with 90% sensible heat factor, has only 0.5 kW of Latent capacity

(can dehumidify/remove only ~0.5 litre of water per hour).

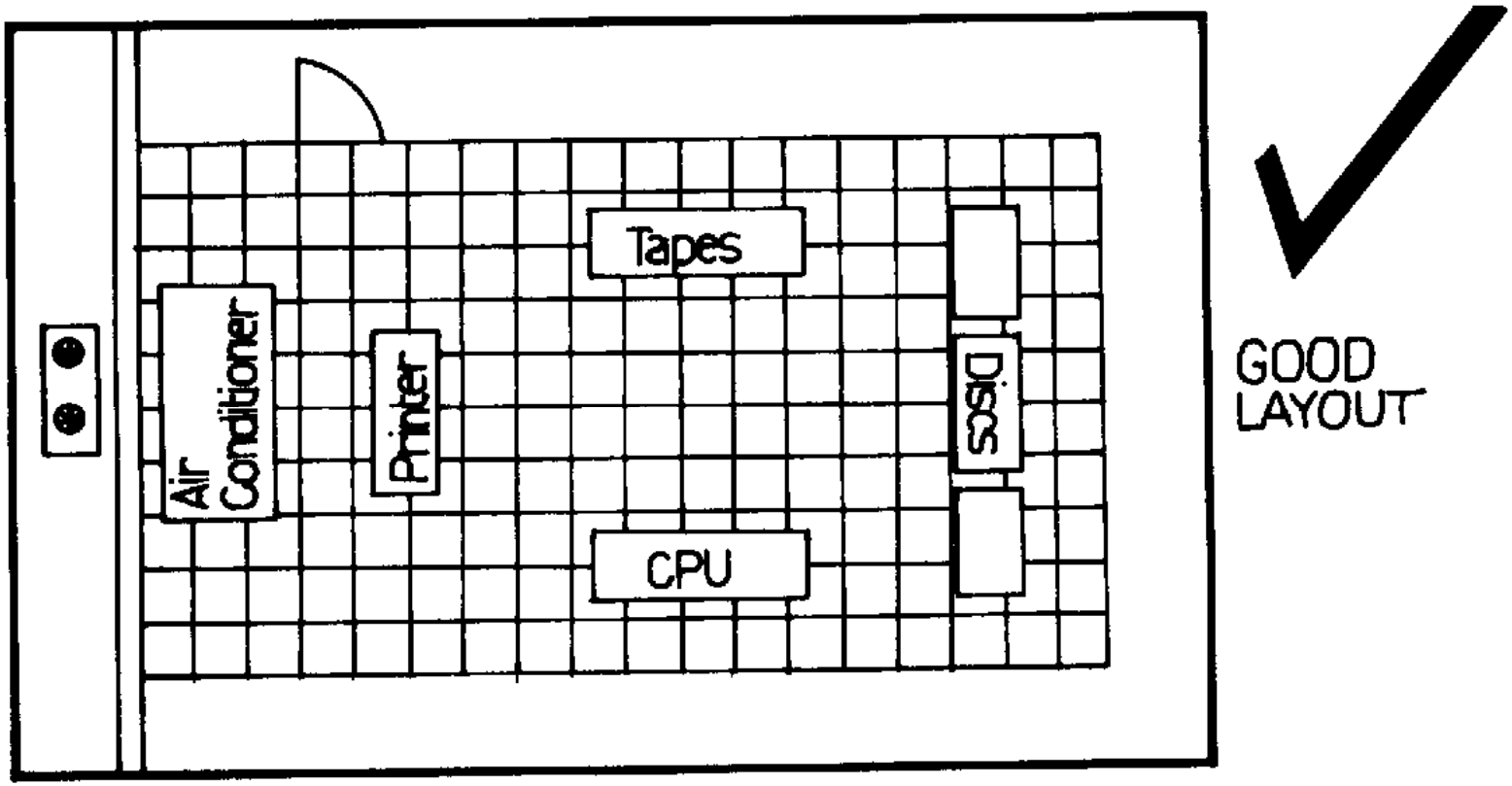
NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts



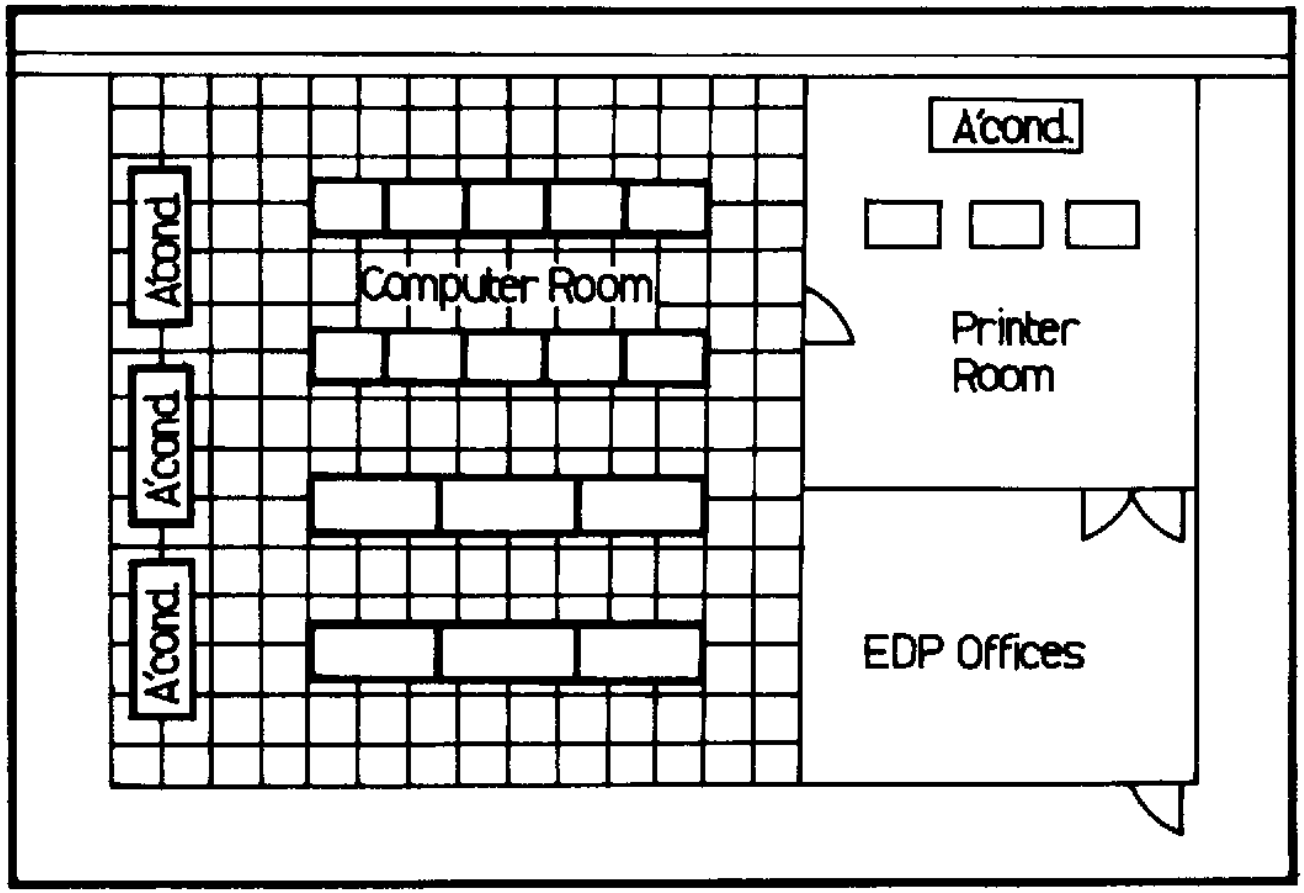
NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts



NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts

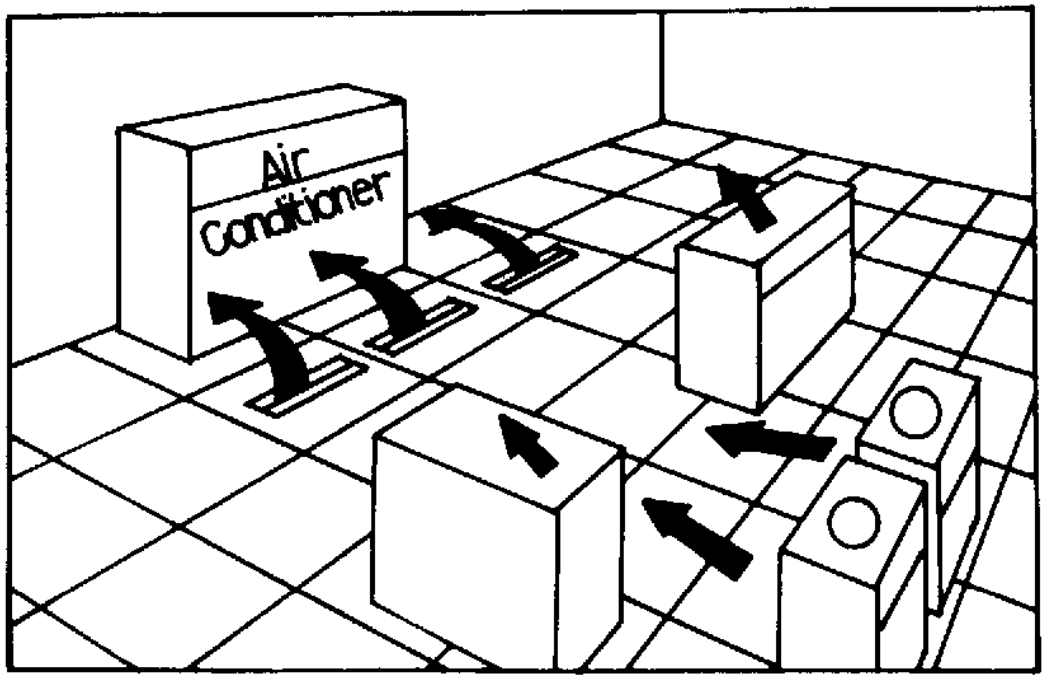


NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts

EQUIPMENT CONFIGURATION

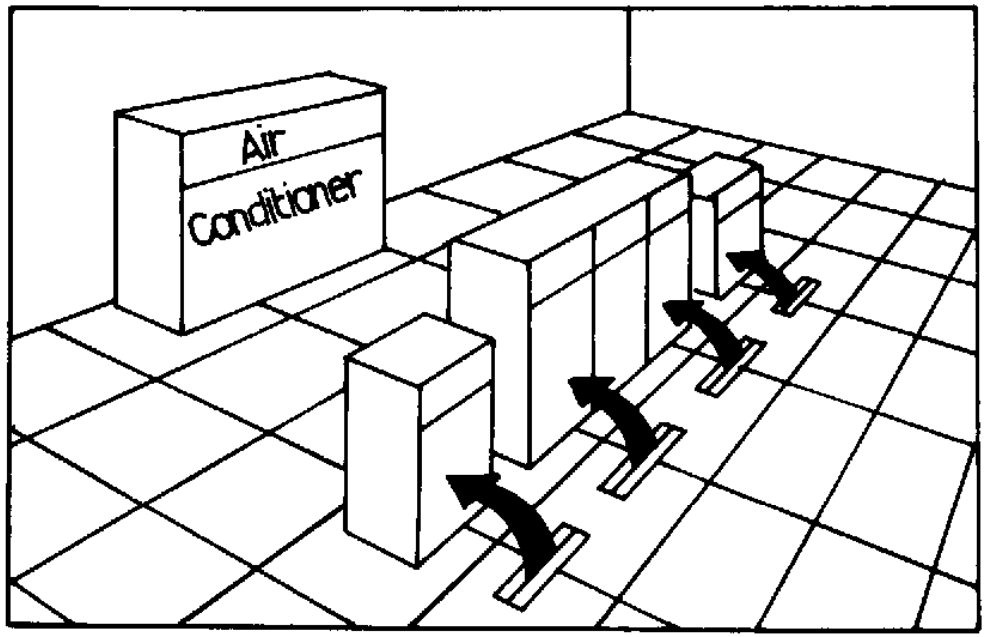
- Avoid floor grilles adjacent to air conditioning equipment otherwise computer heat is not cooled by supply air and bad room conditions result



NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts

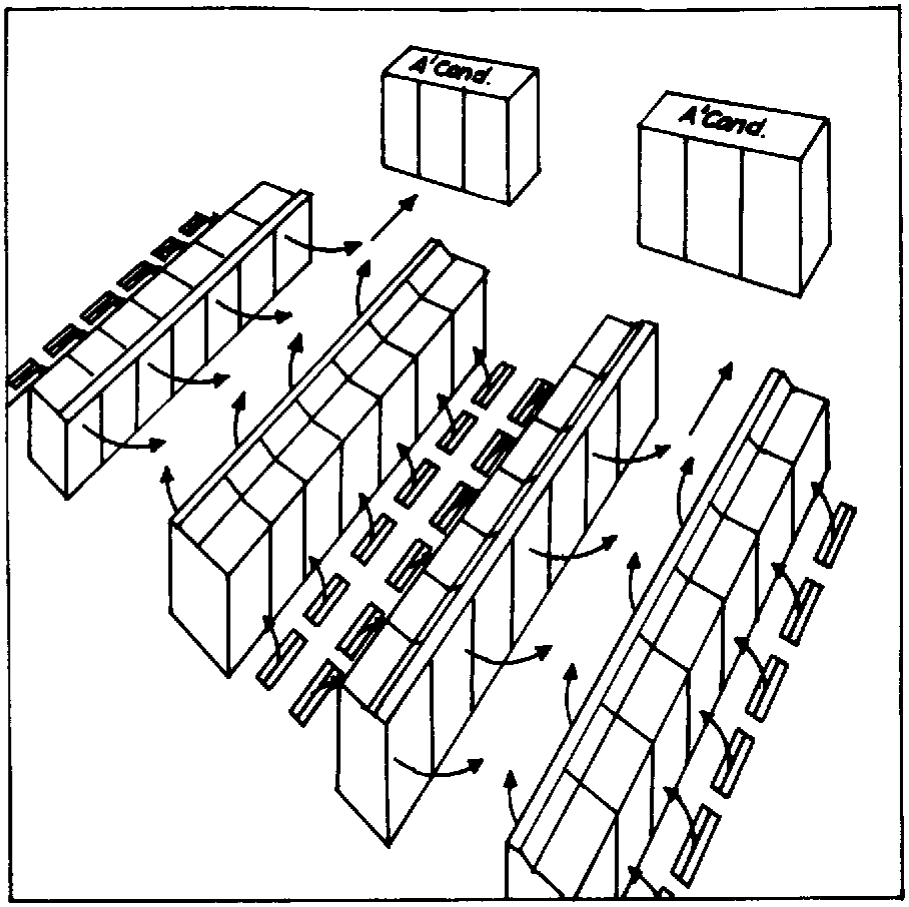
- Locate air conditioning behind heat sources for smaller configurations and position floor grilles to cool individual computer cabinets.



NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts

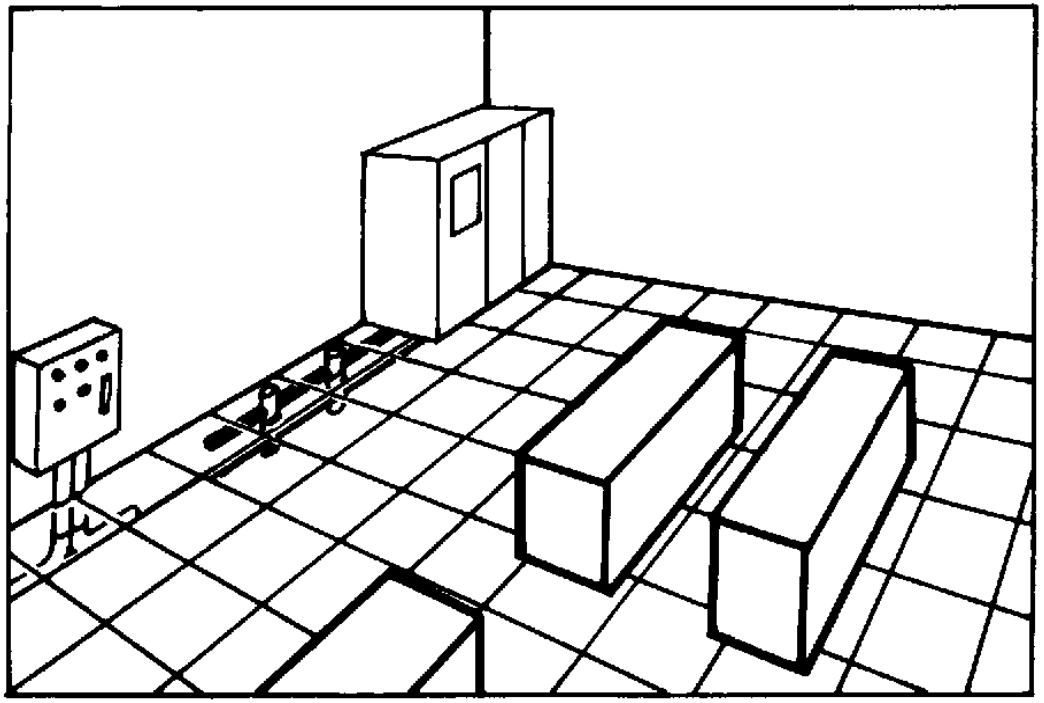
- For installations with multiple rows of equipment, locate air conditioning at the ends of the rows to prevent hot air from one row entering adjacent equipment - eg: disc drives



NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

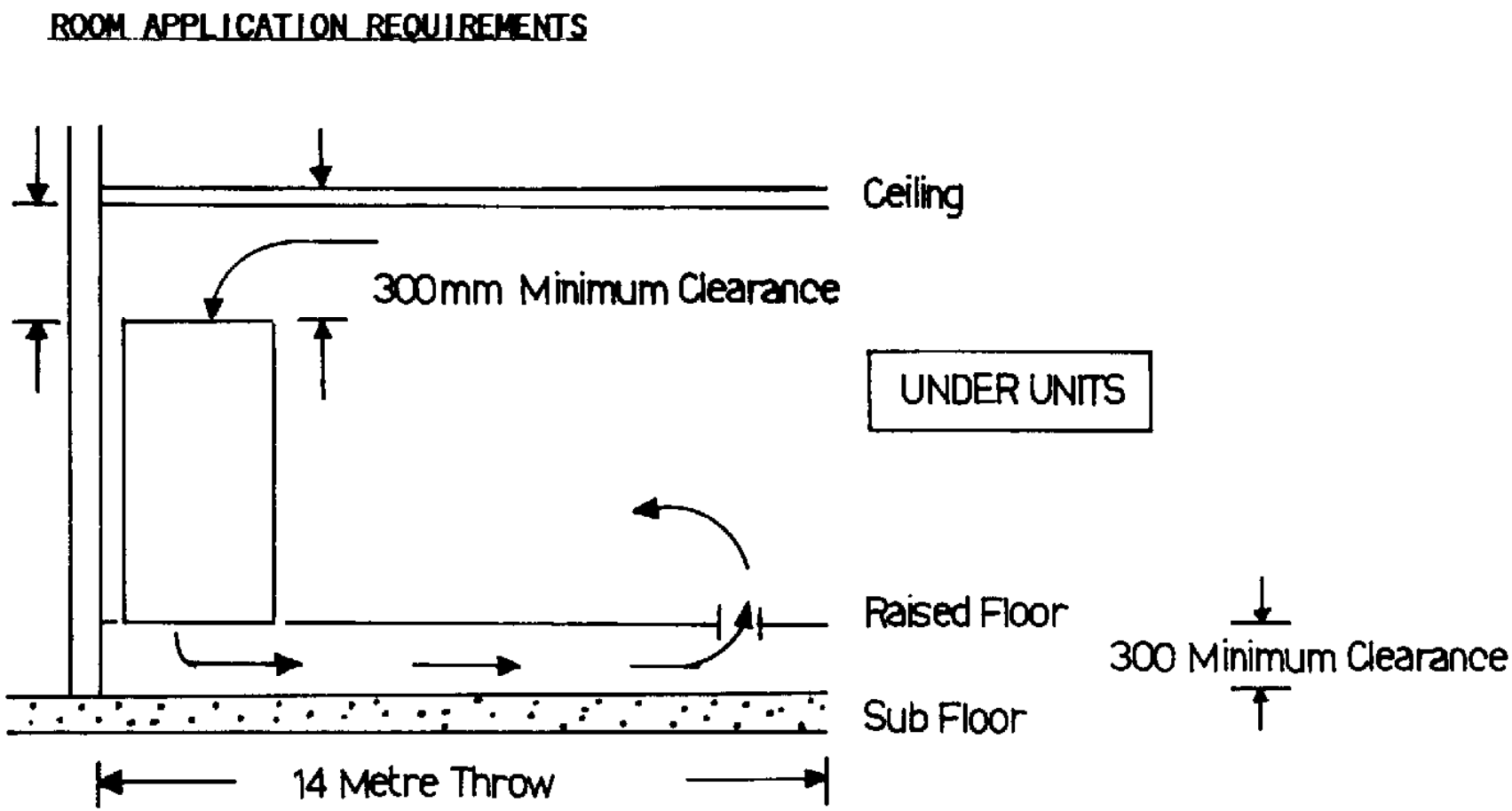
Do’s and Don’ts

- Install air conditioning power and pipework systems around the perimeter of the room to eliminate interference with the computer operations



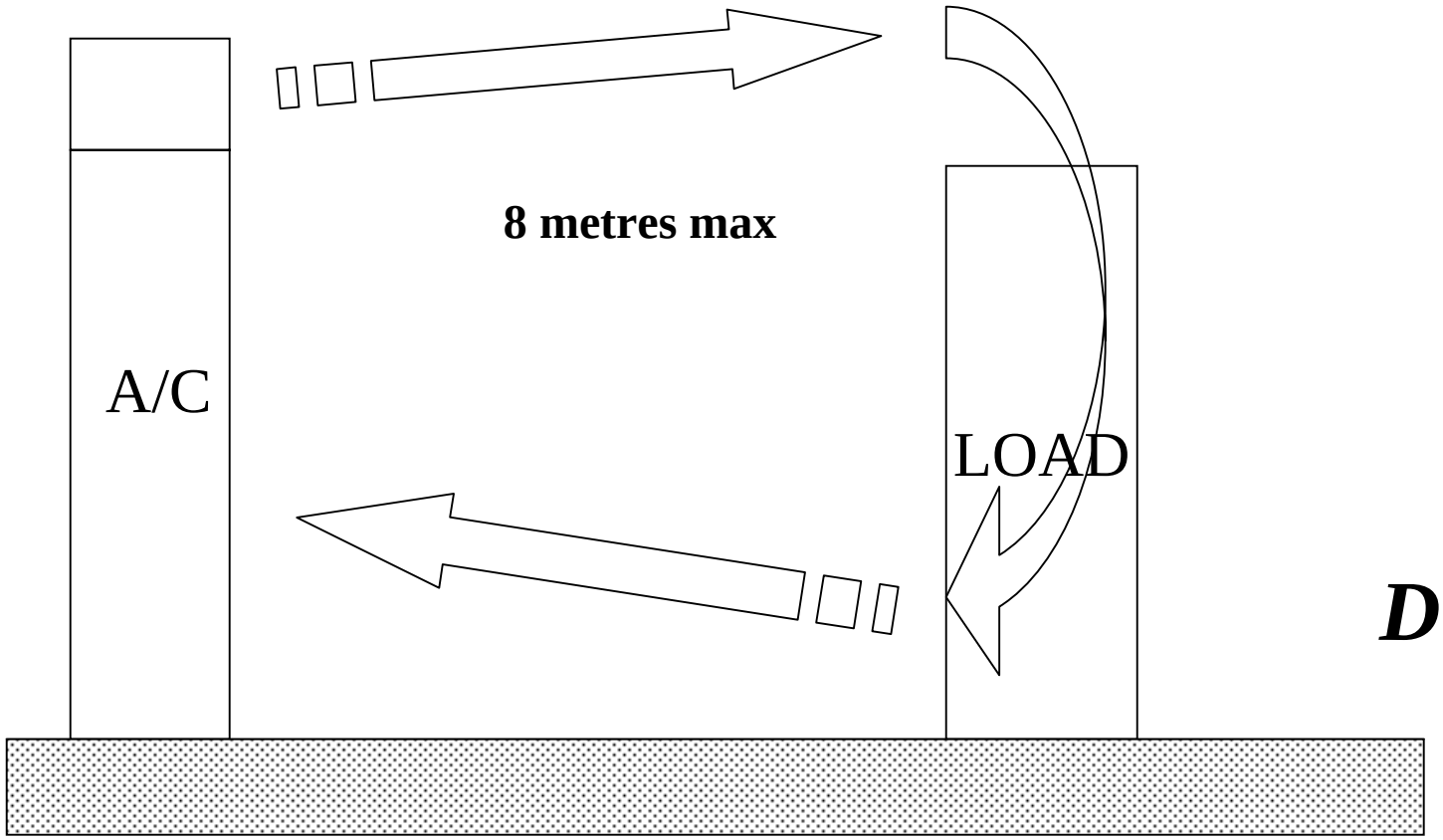
NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts



NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

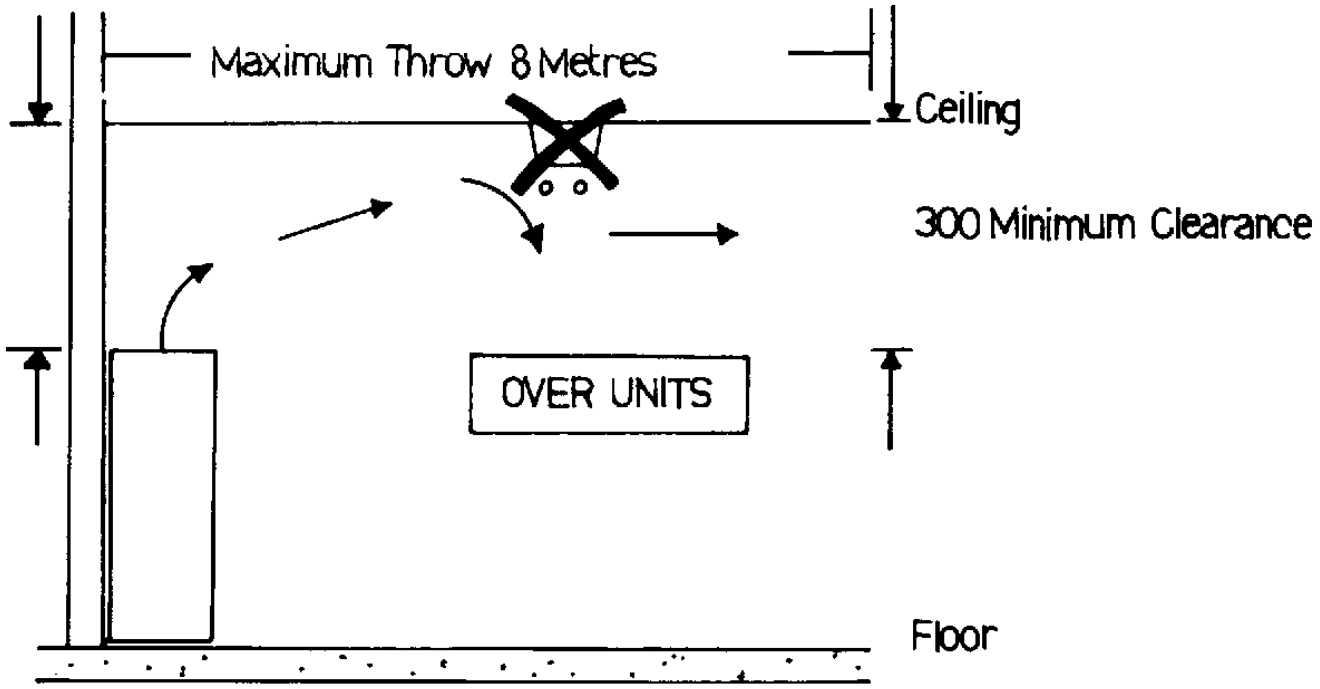
Do’s and Don’ts



DO

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

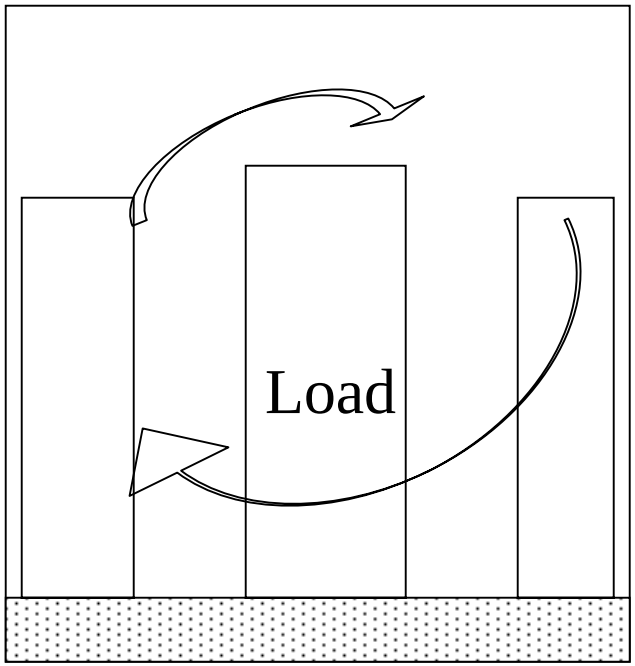
Do’s and Don’ts

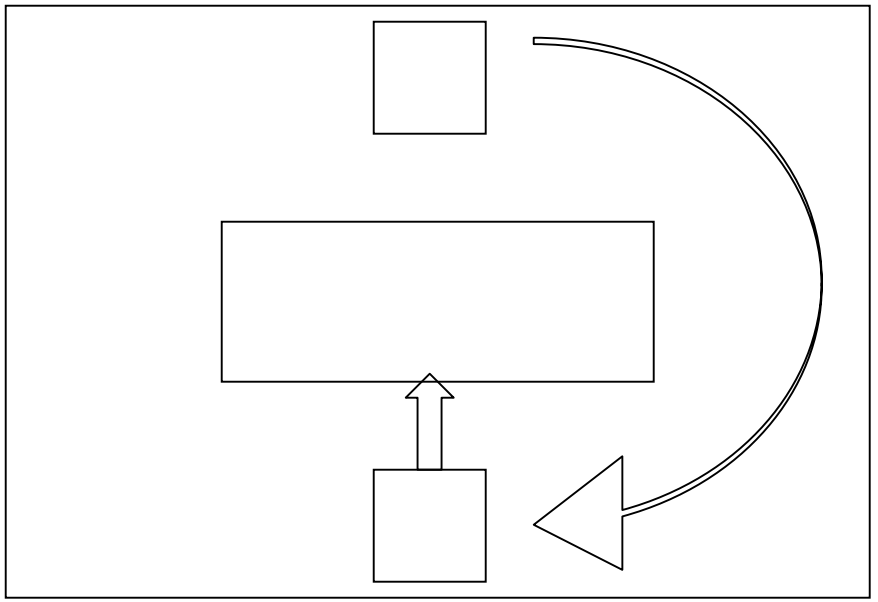


Exposed light fittings in over systems can interrupt airflow and affect room conditions.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

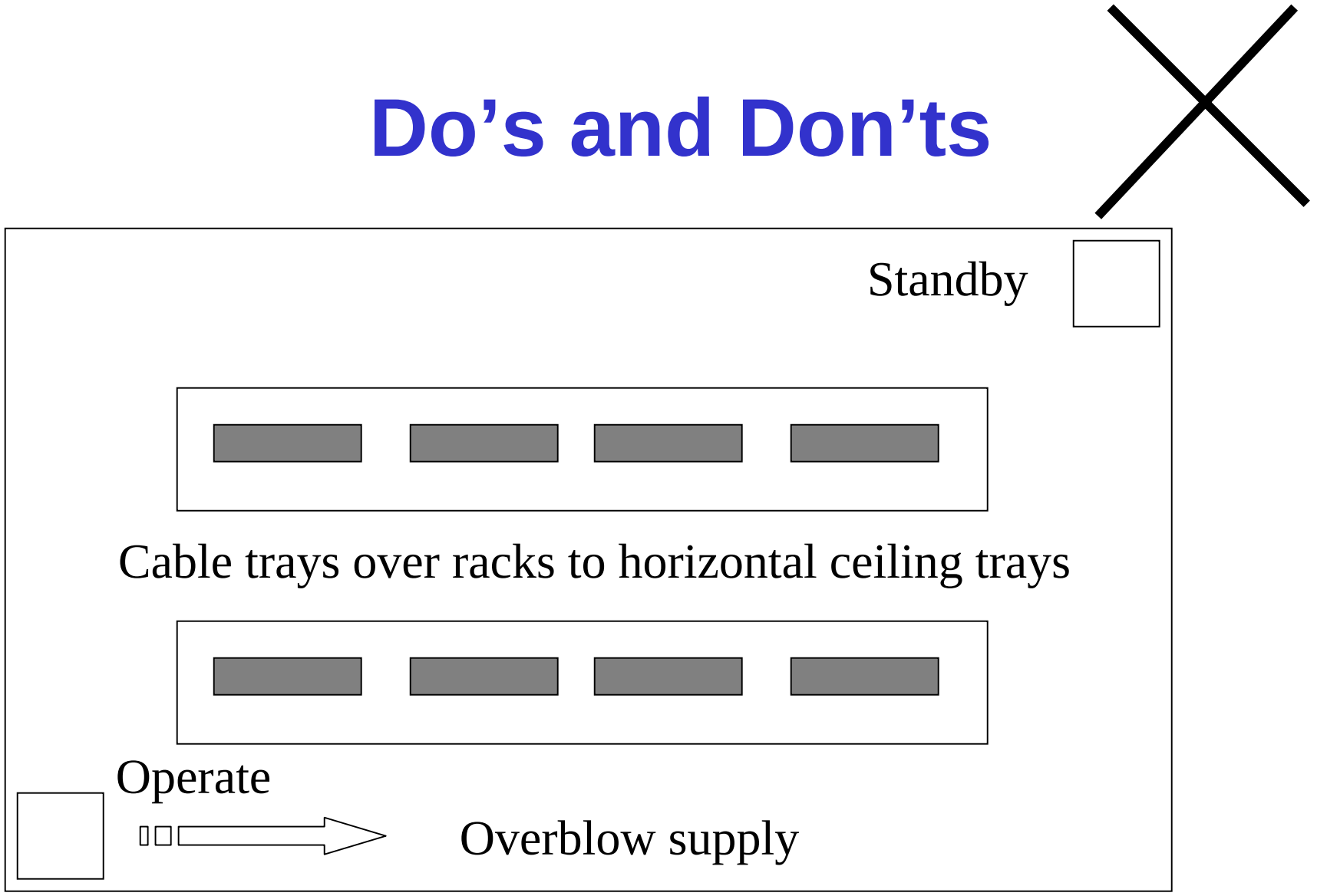
Do’s and Don’ts





NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Do’s and Don’ts



NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Controls response

The air change rate in a room with 0.6 kW/m² with 2.4 m ceiling height and an airflow of 100 l/s per kW of cooling

= 90 air changes/hour

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Controls response

Changes in Load conditions are reflected at the unit (controls) in **under 1 minute** (delivery)

This requires that the Load calculation plus the equipment are selected carefully so that temperature tolerances can be met.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection

A room of 60m^2 with 2.7 m room height (floor to ceiling incl. floor plenum) with a room load of 40kW (0.67 kW/m^2) and an airflow of 4000 l/s

Selection:

1 x 40 kW 2 circuit unit (operative) plus,

1 x 40 kW 2 circuit unit (standby).

Selected equipment which provides 50 kW Gross total and sensible.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection

Selected equipment which provides 50 kW Gross total and sensible.

Room fabric 0.1 kW/m2 = 6 kW.

When fabric load is zero - Load = 34 kW

Winter operation Load = 31 kW

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection

With 50 kW 2 step unit

Step 1 = **22** kW (25 kW minus 3 kW fan heat)

+Step 2 = **47** kW

The 31 kW cooling requirement is met by the Step 1 continuous cooling and Step 2 cycling 36% on.

When two steps room over-cooled by **16 kW**

When one step room under-cools by **9 kW**

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection

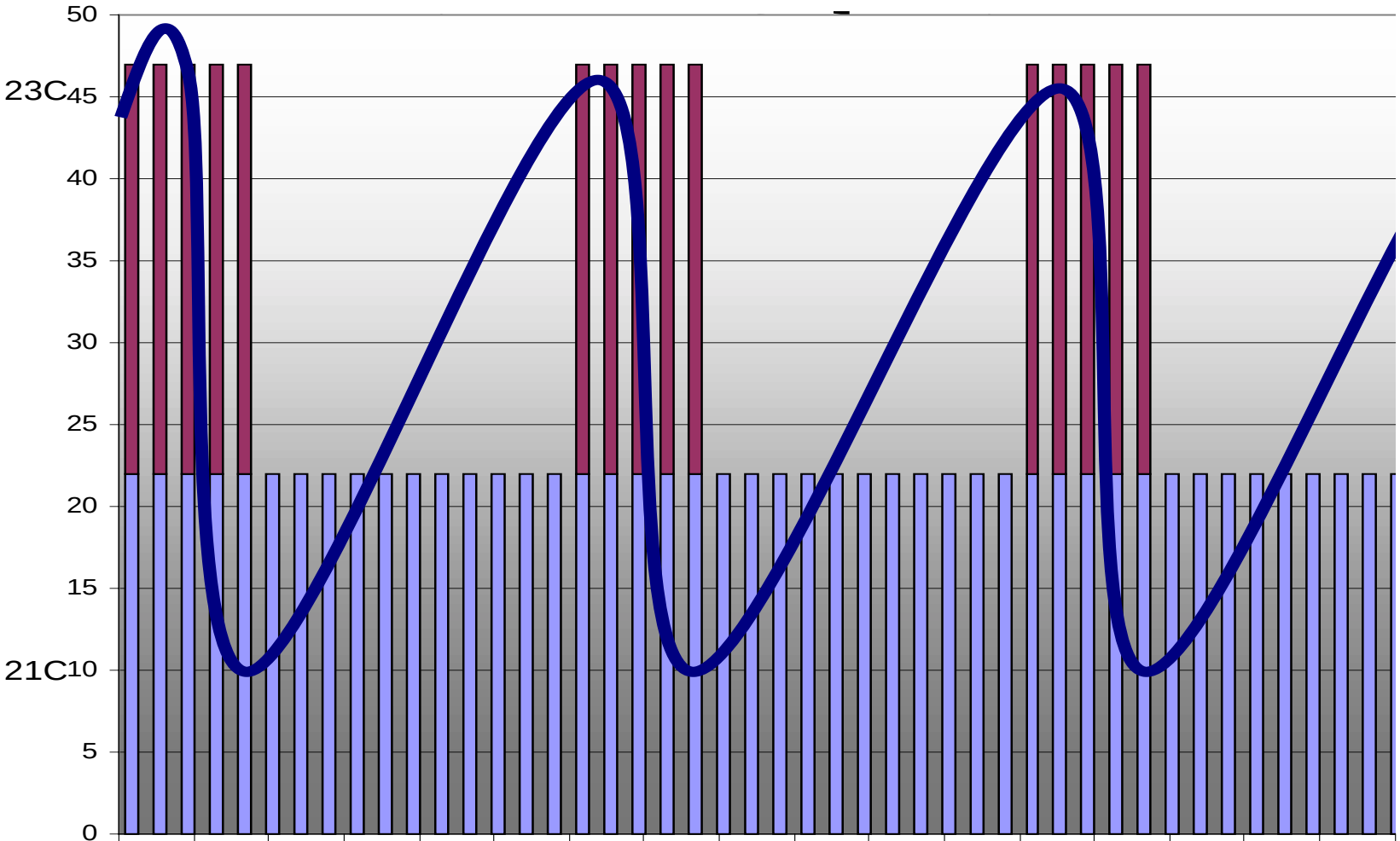
Hence pull-down time on 2 Step cool is 2 ºC (±2ºC) in 25 seconds + delivery (~20 seconds).

Then time to next cooling call for Step 2 is 44 seconds plus delivery (~ 20 seconds).

Cycles ~ every 2½ minutes or

24 starts per hour.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD



	0:00:00	0:00:33	0:00:55	0:01:28	0:02:01	0:02:23	0:02:56	0:03:29	0:03:51	0:04:24	0:04:57	0:05:19	0:05:52	0:06:25	0:06:47	0:07:20	0:07:53
Step2	25	25	0	0	0	0	25	25	0	0	0	0	25	25	0	0	0
Step 1	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection

Same room / same conditions - With **3 x 26 kW** units selecting **2 operating** and 1 standby.

4 available compressors

Unit 1 Step 1 & 2 (2 steps) = **24** kW net

(*26 kW minus 2 kW fan heat)*

Unit 2 Step 1 (3rd step) = 11 kW

total cooling = **35** kW

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

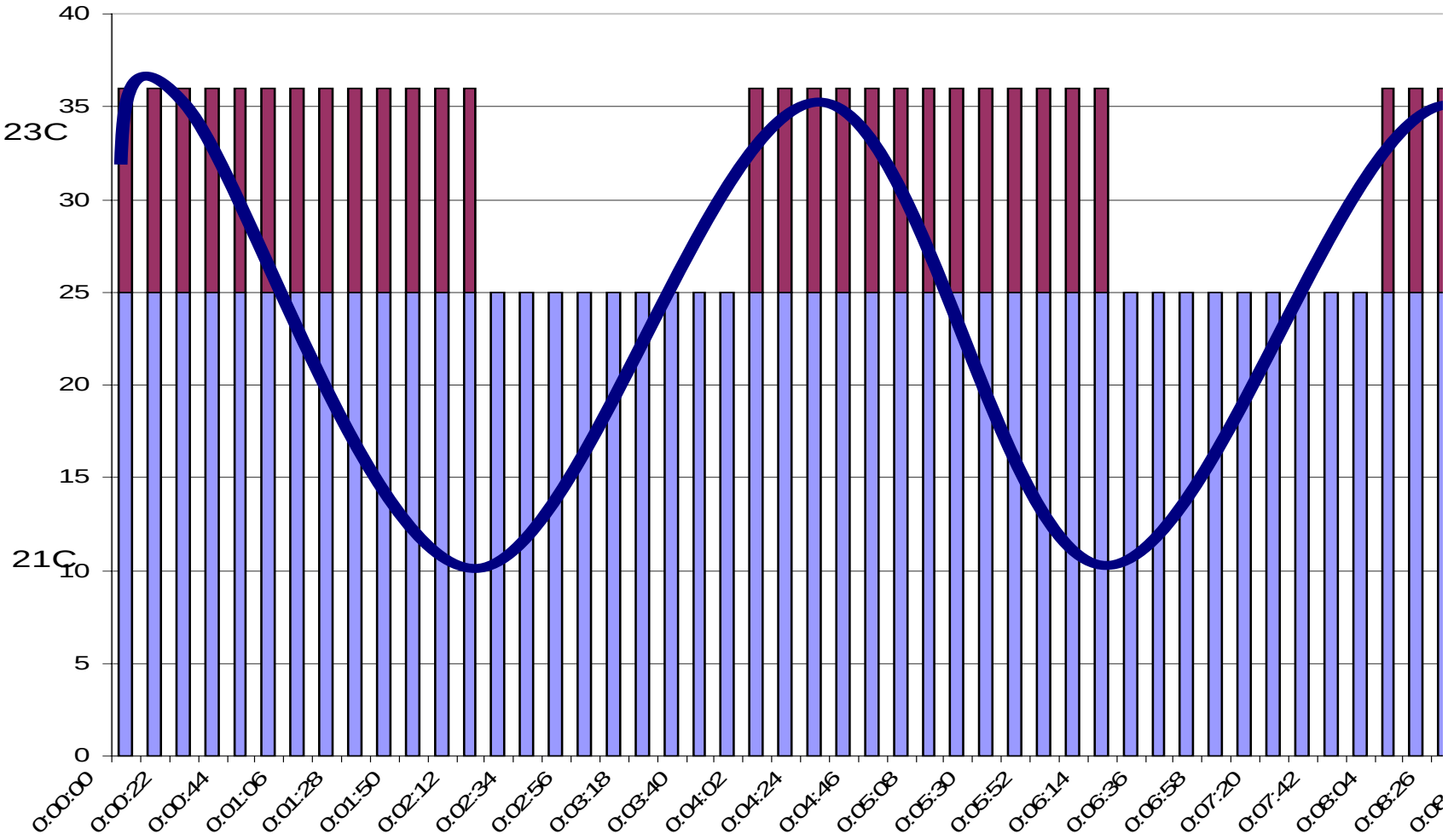
Equipment Selection

Hence compressor Unit 2 Step 1 (3rd step) runs 64% of the time

cooling requirement is met by the Step 1 & 2 continuous cooling and 3rd Step cycling 64% on.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection



NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection

Three steps over-cools by 4 kW

Two steps under-cools by 7 kW

Hence pull-down time on 3rd Step is 2ºC (±2 ºC) in 100 seconds plus delivery (20 seconds).

Then time to next cooling call for 3rd Step is 60 seconds plus delivery (~ 20 seconds).

Cycles ~ every 4 minutes or **15 starts per hour**.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Equipment Selection

Initial Investment Increase:

3x 26 kW units =	~$80,000
2x 40 kW units =	~$70,000
Difference (equipment)	~$10,000
plus installation	~$ 5,000
	~$15,000

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

Air Cooled Condenser Selection

Select condensers for normal design ambient - not abnormal ambient temperatures:

Sydney = **32 ^{o}C** - **not 40^{o}C**

Higher ambient temperatures usually last but a few hours and result in performance reductions of possibly 5% capacity.

These units run 24 hours/day year-through, so oversizing of condensers causes greater problems during low (winter) ambient temperature conditions.

Low condensing pressures force down unit suction temperatures which cause unnecessary dehumidification - which then requires the humidifier to operate unnecessarily.

NEW DIRECTIONS
INTERNATIONAL BUSINESS SERVICES PTY LTD

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