BCA2010 – Section J
INSULATION

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Section J – Changes 2009 to 2010

- **Objective JO1 -** to reduce greenhouse gas emissions ~~by efficiently using energy~~
- **Functional Statement JF1 –** To reduce greenhouse gas emissions, to the degree necessary-
  - (a) a building, including its *services*, is to be capable of efficiently using energy; and
  - (b) a building's *services* for heating are to obtain their energy from-
    - (i) a source that has a low greenhouse gas intensity; or
    - (ii) a source that is renewable on-site; or
    - (iii) another process as reclaimed energy.
- (JP3 – low greenhouse intensity : $\leq$ 100g CO_2-e/MJ)

Section J – Changes to DTS

- Stringency increased for
  - R-values for walls, roofs, and floor
  - Windows
  - Lighting levels
  - Chiller performance
  - Fan and pump power
  - Ductwork and piping insulation
- New energy metering requirements
- EDH – mistakenly removed!

Section J – Metering & EDHs

- Metering (J8.3)
  - ≥ 500m² - record electricity and gas consumption
  - ≥ 2,500 m² - more detailed recording (HVAC systems, lighting, appliance power, central HHW, other building systems, other ancillary plant)
- EDHs
  - Corrected in BCA2011 – refer BCA2011 – Volume One – Public Comment Draft

Section J – Energy Saving
– Sydney (MJ/m².annum)

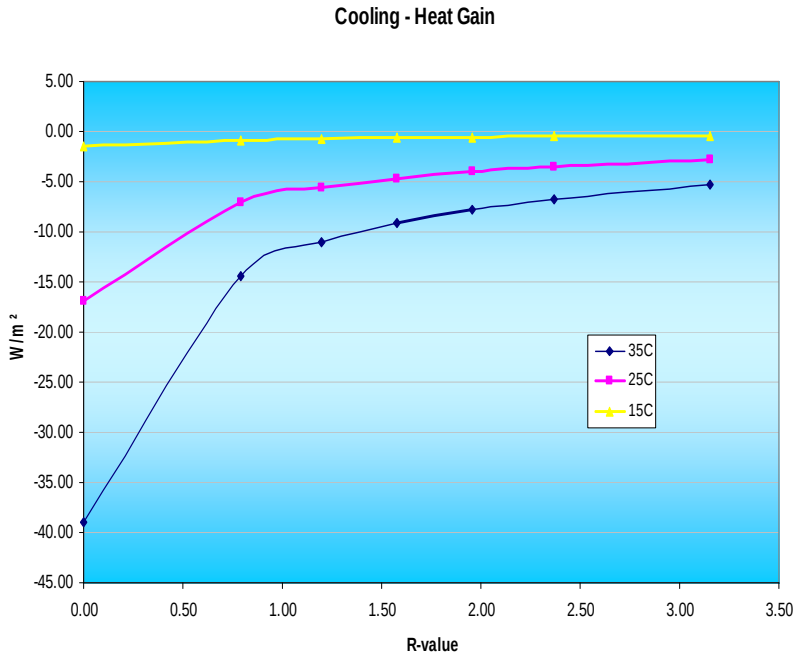
	Base (2009)	Glass +Ins	+Lights (9W/m²)	+7.5(l/s) /person	+fan power	+pump power
Lighting	126.3	126.3	113.7	113.7	113.7	113.7
Power	235.2	235.2	235.2	235.2	235.2	235.2
Tenant Total	361.5	361.5	348.9	348.9	348.9	348.9
Cool	222.6	203.4	200	200.3	173.3	172.7
Heat	11.8	7.3	7.5	0	9.5	9.5
Fans	240.3	207.2	206.3	206.3	133.3	133.3
Pumps+Aux.	16.6	14.9	14.8	14.7	13.6	11.3
Building Only	491.3	432.9	428.6	421.2	329.7	326.7
	100%	**88%**	**87%**	**86%**	**67%**	**66%**
Building + Tenant	852.8	794.4	777.5	770.1	678.6	675.6
	100%	**93%**	**91%**	**90%**	**80%**	**79%**

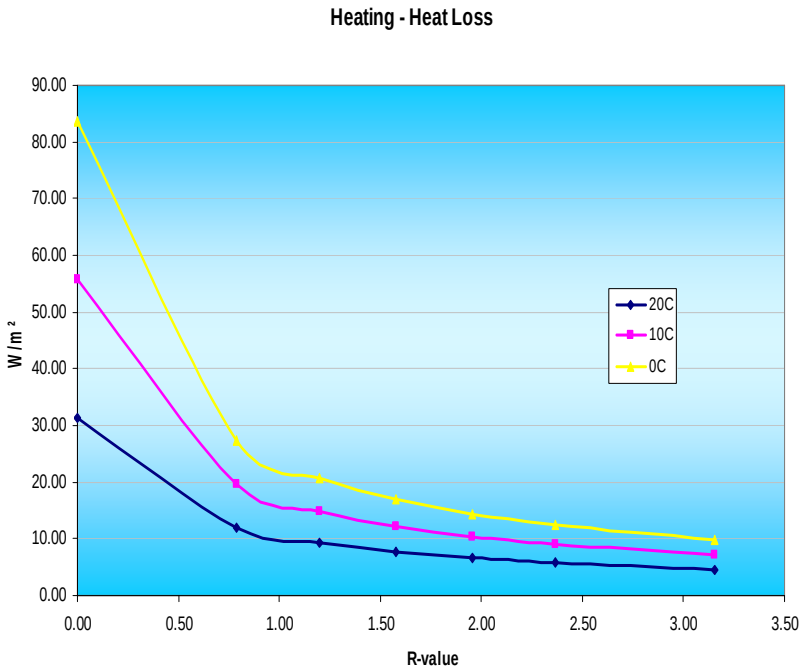
Summary of 12 sites assessed including Brisbane data

Site No.		1	2	3	4	5	6	7	8	9	10	11	12
Building	Building Class	Class 5	Class 5	Class 8	Class 5	Class 9b	Class 5	Class 8	Class 5	Class 8	Class 5	Class 5	Class 5
	Descriptor	Police Station	Police Station	Laboratory	Police Station	University	Police Station	Laboratory	Police Station	Factory			
	Air Conditioned Area (m^2)	905	2597	249	2542	1012	1609.2	951	1346	6838	39946	26406	50002
	Cooling Load (kWr)	146.3	370.76	89.2	370	200.2	238.85	276.5	211.22	1193.8	6790.8	4489.0	8500.3
	Heating Load (kW)	100.1	169.72	40.7	227.4	118.2	186.9	207.8	155.2	506.35			
Fan	Cooling Load (W/m^2)	161.7	195.1	358.2	145.6	197.8	148.4	290.7	156.9		170.0	170.0	170.0
	Treated Area (m^2)	905	2597	249	2542	1012	1609.2	951	1346		9051	1185	16021
	Power (kW)	7.60	20.32	5.88	13.85	8.60	13.62	14.28	9.96		126.50	9.90	164.00
ChWP	Cooling Load (W/m^2)	158.0	133.3	NA	138.3	NA	NA	NA	NA	174.6	170.0	170.0	170.0
	Treated Area (m^2)	655	2370		1783					6838	39946	26406	50002
	Power (kW)	1.33	6.24	0.00	3.36	0.00	0.00	0.00	0.00	20.00	100.00	66.00	93.00
HHWP/CWP	Load (W/m^2)	116.2	61.9	NA	82.1	NA	NA	NA	NA	74.0			
	Treated Area (m^2)	655	2370		1783					6838	39946	26406	50002
	Power (kW)	0.33	1.21	0.00	0.57	0.00	0.00	0.00	0.00	6.43	160.00	103.00	207.00
W/m^2	Fan	8.4	7.8	23.6	5.4	8.5	8.5	15.0	6.5	0.0	14.0	8.4	10.2
	ChWP	2.0	2.6	0.0	1.9	0.0	0.0	0.0	0.0	2.9	2.5	2.5	1.9
	HHWP / CWP	0.5	0.5	0.0	0.3	0.0	0.0	0.0	0.0	0.9	4.0	3.9	4.1
Proposed BCA 2010	Fan (W/m^2)	14.1	14.1	23.6	15	14.1	10.4	21.5	14.1	NA	14.1	14.1	14.1
		below limit	below limit	at limit	below limit	below limit	below limit	below limit	below limit	NA	below limit	below limit	below limit
	ChWP (W/m^2)	2	1.7	NA	1.7	NA	NA	NA	NA	2	2	2	2
		below limit	above limit	NA	above limit	NA	NA	NA	NA	above limit	above limit	above limit	below limit
	HHWP / CWP(W/m^2)	1.1	0.8	NA	0.8	NA	NA	NA	NA	0.8	2.2	2.2	2.2
		below limit	below limit	NA	below limit	NA	NA	NA	NA	above limit	above limit	above limit	above limit

Spec. J5.2 – Ductwork Insulation

- Analysis Methodology
  - Average minimum and maximum location temperatures
  - Calculate average heat gain (cooling) and heat loss (heating); W/m²
  - Simple ductwork designs for 10kW, 25kW, 50kW, 75kW cooling and heating
  - Alan Obrart report ABCB website





Spec. J5.2 – Ductwork Insulation, Cooling

COOLING		R:	0.00	0.79	1.20	1.58	1.96	2.37	3.15	
External	Capacity, W	1,2,3 & 5	-39.04	-14.39	-11.03	-9.11	-7.78	-6.72	-5.34	W/m²
	10000	35C	-6.2%	-2.3%	-1.8%	-1.5%	-1.2%	-1.1%	-0.9%	
	25000		-5.6%	-2.1%	-1.6%	-1.3%	-1.1%	-1.0%	-0.8%	
	50000		-5.6%	-2.1%	-1.6%	-1.3%	-1.1%	-1.0%	-0.8%	
	75000		-5.8%	-2.1%	-1.6%	-1.4%	-1.2%	-1.0%	-0.8%	
		Average	-5.8%	-2.2%	-1.7%	-1.4%	-1.2%	-1.0%	-0.8%	
	Capacity, W	4,6 & 7	-16.86	-7.12	-5.57	-4.65	-4.00	-3.48	-2.79	W/m²
	10000	25C	-2.7%	-1.1%	-0.9%	-0.7%	-0.6%	-0.6%	-0.4%	
	25000		-2.4%	-1.0%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	
	50000		-2.4%	-1.0%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	
	75000		-2.5%	-1.1%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	
		Average	-2.5%	-1.1%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	
	Capacity, W	8	-1.48	-0.85	-0.71	-0.61	-0.54	-0.48	-0.40	W/m²
	10000	15C	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	
	25000		-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	
	50000		-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	
	75000		-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	
		Average	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	
Internal	Capacity, W	Internal	-15.73	-6.97	-5.49	-4.61	-3.97	-3.46	-2.78	W/m²
	10000	25C	-3.8%	-1.7%	-1.3%	-1.1%	-1.0%	-0.8%	-0.7%	
	25000		-3.3%	-1.5%	-1.1%	-1.0%	-0.8%	-0.7%	-0.6%	
	50000		-3.0%	-1.3%	-1.0%	-0.9%	-0.7%	-0.7%	-0.5%	
	75000		-3.4%	-1.5%	-1.2%	-1.0%	-0.8%	-0.7%	-0.6%	
		Average	-3.4%	-1.5%	-1.2%	-1.0%	-0.8%	-0.7%	-0.6%	

Spec. J5.2 – Ductwork Insulation, Heating

HEATING		R:	0.00	0.79	1.20	1.58	1.96	2.37	3.15	
External	Capacity, W	1,2,3 & 5	31.22	12.07	9.31	7.72	6.61	5.72	4.56	W/m²
	10000	20C	4.4%	1.7%	1.3%	1.1%	0.9%	0.8%	0.6%	
	25000		3.7%	1.4%	1.1%	0.9%	0.8%	0.7%	0.5%	
	50000		4.0%	1.5%	1.2%	1.0%	0.8%	0.7%	0.6%	
	75000		3.0%	1.2%	0.9%	0.7%	0.6%	0.5%	0.4%	
		Average	3.8%	1.5%	1.1%	0.9%	0.8%	0.7%	0.5%	
	Capacity, W	4,6 & 7	55.70	19.58	14.92	12.28	10.46	9.02	7.15	W/m²
	10000	15C	7.8%	2.7%	2.1%	1.7%	1.5%	1.3%	1.0%	
	25000		6.7%	2.3%	1.8%	1.5%	1.3%	1.1%	0.9%	
	50000		7.1%	2.5%	1.9%	1.6%	1.3%	1.2%	0.9%	
	75000		5.3%	1.9%	1.4%	1.2%	1.0%	0.9%	0.7%	
		Average	6.7%	2.4%	1.8%	1.5%	1.3%	1.1%	0.9%	
	Capacity, W	8	83.56	27.40	20.72	16.97	14.40	12.38	9.78	W/m²
	10000	0C	11.7%	3.8%	2.9%	2.4%	2.0%	1.7%	1.4%	
	25000		10.0%	3.3%	2.5%	2.0%	1.7%	1.5%	1.2%	
	50000		10.7%	3.5%	2.7%	2.2%	1.8%	1.6%	1.3%	
	75000		8.0%	2.6%	2.0%	1.6%	1.4%	1.2%	0.9%	
		Average	10.1%	3.3%	2.5%	2.1%	1.7%	1.5%	1.2%	
Internal	Capacity, W	Internal	28.63	11.74	9.13	7.60	6.53	5.67	4.53	W/m²
	10000	20C	6.0%	2.5%	1.9%	1.6%	1.4%	1.2%	1.0%	
	25000		5.0%	2.1%	1.6%	1.3%	1.1%	1.0%	0.8%	
	50000		4.7%	1.9%	1.5%	1.2%	1.1%	0.9%	0.7%	
	75000		4.6%	1.9%	1.5%	1.2%	1.0%	0.9%	0.7%	
		Average	5.1%	2.1%	1.6%	1.3%	1.2%	1.0%	0.8%	

Spec. J5.2 – Ductwork Insulation

Table 3 DUCTWORK AND FITTINGS - MINIMUM MATERIAL R-VALUE

Location of ductwork and fittings	Location of ductwork and Minimum material R-Value for ductwork and fittings in each climate zone		
	1, 2, 3 and 5	4, 6 and 7	8
Within a conditioned space	1.2	1.0	1.6
Where exposed to direct sunlight	3.0	3.0	3.4
All other locations	2.0	2.0	2.4

Spec. J5.4 – Piping Insulation

- Analysis Methodology
  - Similar approach to Ductwork Analysis
  - Average minimum and maximum location temperatures
  - Calculate average heat gain (cooling) and heat loss (heating); W/m²
  - Simple piping designs for systems of
    - <65kW
    - 65kW to ≤250kW, and
    - >250kW
- Alan Obrart Report on ABCB website

Spec. J5.4 – Piping Insulation

CHILLED WATER	1,2,3 & 5	4,6 & 7	8
approx. mean maxima, C	35	25	15
Exposed, capacity < 65kW			
insulation R	1.1	0.7	0.7
Loss, W/m	5.2	4.1	1.4
% / m loss	0.013%	0.010%	0.003%
Exposed, 65kW ≤ capacity < 250kW			
insulation R	1.8	1.4	1.1
Loss, W/m	5.8	4.1	1.7
% / m loss	0.003%	0.002%	0.001%
Exposed, capacity ≥ 250kW			
insulation R	2.1	1.8	1.4
Loss, W/m	5.2	4.1	1.9
% / m loss	0.001%	0.001%	0.000%

HOT WATER	1,2,3 & 5	4,6 & 7	8
approx. mean minima, C	15	10	0
Exposed, cap. < 65kW			
insulation R	1.1	1.1	1.4
Gain, W/m	11.2	12	11.6
% / m gain	0.015%	0.017%	0.016%
Exposed, cap. ≥ 65kW			
insulation R	1.1	1.4	1.8
Gain, W/m	14.7	13.2	10.7
% / m gain	0.007%	0.007%	0.005%

Spec. J5.4 – Piping Insulation

Location	Minimum material *R-Value* for each *climate zone*		
	1, 2, 3 and 5	4,6 and 7	8
1. Heating water *piping* for systems of no more than 65 $kW_{heating}$ capacity			
(a) Located internally	(0.2) 1.0	(0.2) 1.0	(0.2) 1.3
(b) Located within a wall space, an enclosed sub-floor area or an enclosed roof space	(0.3)1.1	(0.45) 1.1	(0.6)1.4
(c) Located outside the building or in an unenclosed sub-floor area or an unenclosed roof space	(0.3) 1.2	(0.6)1.2	(0.6) 1.5
2. Heating water *piping* for systems of more than 65 $kW_{heating}$ capacity			
(a) Located internally	(0.5) 1.0	(0.6) 1.0	(0.8) 1.7
(b) Located within a wall space, an enclosed sub-floor area or an enclosed roof space	(0.6 1.1	(0.7)1.1	(0.9)1.8
(c) Located outside the building or in an unenclosed sub-floor area or an unenclosed roof space	(0.7)1.2	(0.8) 1.5	(1.0) 1.9

3. Cooling water *piping* for systems of no more than 65 kWr capacity			
(a) Located internally	1.0	0.6	0.6
(b) Located within a wall space, an enclosed sub-floor area or an enclosed roof space	1.1	0.7	0.7
(c) Located outside the building or in an unenclosed sub-floor area or an unenclosed roof space	1.2	0.8	0.8
4. Cooling water *piping* for systems of more than 65 kWr capacity but no more less than 250 kWr capacity			
(a) Located internally	(1.0) 1.7	(0.9)1.3	(0.8) 1.0
(b) Located within a wall space, an enclosed sub-floor area or an enclosed roof space	(1.1)1.8	(1.0) 1.4	(0.9) 1.1
(c) Located outside the building or in an unenclosed sub-floor area or an unenclosed roof space	(1.2) 1.9	(1.1) 1.5	(1.0) 1.2
5. Cooling water *piping* for systems of more than 250 kWr capacity			
(a) Located internally	(1.5) 2.0	(1.2) 1.7	(1.0) 1.3
(b) Located within a wall space, an enclosed sub-floor area or an enclosed roof space	(1.6) 2.1	(1.3) 1.8	(1.1) 1.4
(c) Located outside the building or in an unenclosed sub-floor area or an unenclosed roof space	(1.8) 2.2	(1.4) 1.9	(1.3) 1.5